LEARNING FROM 9/11—UNDERSTANDING THE COLLAPSE OF THE WORLD TRADE CENTER

HEARING

BEFORE THE

COMMITTEE ON SCIENCE
HOUSE OF REPRESENTATIVES

ONE HUNDRED SEVENTH CONGRESS

SECOND SESSION

MARCH 6, 2002

Serial No. 107–46A

VOLUMES I & II

Printed for the use of the Committee on Science

Available via the World Wide Web: http://www.house.gov/science

U.S. GOVERNMENT PRINTING OFFICE
85–835PS WASHINGTON : 2003

For sale by the Superintendent of Documents, U.S. Government Printing Office
Internet: bookstore.gpo.gov Phone: toll free (866) 512–1800; DC area (202) 512–1800
Fax: (202) 512–2250 Mail: Stop SSOP, Washington, DC 20402–0001

COMMITTEE ON SCIENCE

HON. SHERWOOD L. BOEHLERT, New York, *Chairman*

LAMAR S. SMITH, Texas
CONSTANCE A. MORELLA, Maryland
CHRISTOPHER SHAYS, Connecticut
CURT WELDON, Pennsylvania
DANA ROHRABACHER, California
JOE BARTON, Texas
KEN CALVERT, California
NICK SMITH, Michigan
ROSCOE G. BARTLETT, Maryland
VERNON J. EHLERS, Michigan
DAVE WELDON, Florida
GIL GUTKNECHT, Minnesota
CHRIS CANNON, Utah
GEORGE R. NETHERCUTT, JR., Washington
FRANK D. LUCAS, Oklahoma
GARY G. MILLER, California
JUDY BIGGERT, Illinois
WAYNE T. GILCHREST, Maryland
W. TODD AKIN, Missouri
TIMOTHY V. JOHNSON, Illinois
MIKE PENCE, Indiana
FELIX J. GRUCCI, JR., New York
MELISSA A. HART, Pennsylvania
J. RANDY FORBES, Virginia

RALPH M. HALL, Texas
BART GORDON, Tennessee
JERRY F. COSTELLO, Illinois
JAMES A. BARCIA, Michigan
EDDIE BERNICE JOHNSON, Texas
LYNN C. WOOLSEY, California
LYNN N. RIVERS, Michigan
ZOE LOFGREN, California
SHEILA JACKSON LEE, Texas
BOB ETHERIDGE, North Carolina
NICK LAMPSON, Texas
JOHN B. LARSON, Connecticut
MARK UDALL, Colorado
DAVID WU, Oregon
ANTHONY D. WEINER, New York
BRIAN BAIRD, Washington
JOSEPH M. HOEFFEL, Pennsylvania
JOE BACA, California
JIM MATHESON, Utah
STEVE ISRAEL, New York
DENNIS MOORE, Kansas
MICHAEL M. HONDA, California

CONTENTS

March 6, 2002

Page
Hearing Charter 2

Opening Statements

Statement by Representative Sherwood L. Boehlert, Chairman, Committee on Science, U.S. House of Representatives 46
  Written Statement 47
Statement by Representative Anthony D. Weiner, Member, Committee on Science, U.S. House of Representatives 48
Statement by Representative Ralph M. Hall, Minority Ranking Member, Committee on Science, U.S. House of Representatives 49
  Written Statement 50
Statement by Representative Steve Israel, Member, Committee on Science, U.S. House of Representatives 50
  Written Statement 51
Statement by Representative Felix J. Grucci, Jr., Member, Committee on Science, U.S. House of Representatives 52
  Written Statement 52
Prepared Statement by Representative Constance Morella, Member, Committee on Science, U.S. House of Representatives 53
Prepared Statement by Representative Nick Smith, Member, Committee on Science, U.S. House of Representatives 54
Prepared Statement by Representative J. Randy Forbes, Member, Committee on Science, U.S. House of Representatives 55
Prepared Statement by Representative Jerry F. Costello, Member, Committee on Science, U.S. House of Representatives 55
Prepared Statement by Representative John B. Larson, Member, Committee on Science, U.S. House of Representatives 56
Prepared Statement by Representative Bob Etheridge, Member, Committee on Science, U.S. House of Representatives 57

Panel

Mr. Robert F. Shea, Acting Administrator, Federal Insurance and Mitigation Administration, Federal Emergency Management Agency 58
  Written Statement 60
  Biography 63
Dr. W. Gene Corley, Senior Vice President, CTL Engineering 64
  Written Statement 66
  Biography 72
  Financial Disclosure 74
Professor Glenn P. Corbett, John Jay College of Criminal Justice 76
  Written Statement 78
  Biography 84
  Financial Disclosure 86
Dr. Abolhassan Astaneh-Asl, Professor, Department of Civil and Environmental Engineering, University of California, Berkeley 87
  Written Statement 88
  Biography 92
  Financial Disclosure 93

Page
Dr. Arden L. Bement, Jr., Director, National Institute of Standards and Technology, U.S. Department of Commerce 94
  Written Statement 96
  Biography 100
Discussion 101

Appendix 1: Additional Material for the Record

Letters expressing support for, and cooperation in, a NIST investigation from FEMA, local authorities, and associations 148
Letter to Mr. Mitchell E. Daniels, Jr., Director, Office of Management and Budget from Mr. Boehlert, Mr. Weiner, Mr. Israel, and other Members of the Committee on Science 165
Statement of the Skyscraper Safety Campaign 167
Statement of the International Code Council 170
Letter to Chairman Boehlert from The Skyscraper Safety Campaign 176
Post-hearing letter from FEMA discussing policy shift 177
Press release on FEMA policy shift 179
FEMA letter to the Port Authority of New York and New Jersey requesting support 181
Port Authority Response 184
Port Authority Confidentiality Agreements 186
Letters to television networks from FEMA requesting World Trade Center footage from 9/11 192
Building Performance Assessment Team Confidentiality Agreement with FEMA 195

LEARNING FROM 9/11—UNDERSTANDING THE COLLAPSE OF THE WORLD TRADE CENTER

WEDNESDAY, MARCH 6, 2002

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE,
Washington, DC.

The Committee met, pursuant to call, at 12:23 p.m., in Room 2318 of the Rayburn House Office Building, Hon. Sherwood L. Boehlert (Chairman of the Committee) presiding.

HEARING CHARTER

COMMITTEE ON SCIENCE
U.S. HOUSE OF REPRESENTATIVES

Learning from 9/11—Understanding the Collapse of the World Trade Center

WEDNESDAY, MARCH 6, 2002
12:00 P.M.–2:00 P.M.
2318 RAYBURN HOUSE OFFICE BUILDING

I. Purpose

On Wednesday, March 6, at noon the House Committee on Science will hold a hearing on the investigation into the collapse of the World Trade Center (WTC). Witnesses from industry, academia, and government will testify on the catastrophic collapse of the WTC complex and subsequent efforts by federal agencies and independent researchers to understand how the building structures failed and why. By scrutinizing the steel and other debris, blueprints and other documents, and recorded images of the disaster, engineers, designers, and construction professionals may learn valuable lessons that could save thousands of lives in the event of future catastrophes, natural or otherwise.

The Committee plans to explore several overarching questions raised by the collapse and the ensuing investigation:

1. What have we learned about how the Federal Government investigates catastrophic building collapses, and are any changes warranted?
2. What have we learned about the collapse of the World Trade Center, including which structural elements failed first, and why?
3. How will we know what changes, if any, are warranted in building and fire codes as a result of lessons learned from the World Trade Center's collapse?
4. Has the World Trade Center disaster exposed any gaps in our understanding of buildings and fire, and are changes needed in the Federal Government's research agenda?

2. Background

At 8:47 a.m. on the morning of September 11, 2001, terrorists crashed a fuel-laden Boeing 767 into the north tower (Tower 1) of the World Trade Center (WTC) complex. Approximately 16 minutes later, a second Boeing 767 slammed into the south tower (Tower 2), exploding upon impact and engulfing several of the building's upper floors in flames. While the performance of both towers exceeded their design specifications—the buildings were designed to withstand the force from the initial impact of a 707 jet—the subsequent structural and fire damage still caused the buildings to fall. Tower 2 collapsed in less than an hour, killing victims trapped above the flames and rescue workers in and around the building. Thirty minutes later, Tower 1 met the same fate. While more than 25,000 people were successfully evacuated from the towers, nearly 3,000 people and emergency responders were killed in the collapses. As the day progressed, the remaining WTC buildings collapsed as well, including Building 7, which burned for 8 hours before crumbling to the ground. Fortunately, the later building collapses produced no casualties.

In the wake of the collapses, search and rescue workers launched an around-the-clock recovery effort to find and recover survivors and victims who perished. To make way, literally tons of twisted steel and fractured concrete were removed from the rubble pile and loaded onto convoys of bulldozers and flatbed trucks to be carried away to recycling plants and landfills.

Researchers also began to respond immediately. Among the first were National Science Foundation (NSF)-funded social scientists and engineers who arrived at the WTC site within 48 to 72 hours after the tragedy to begin collecting data. Similarly, the American Society of Civil Engineers (ASCE) formed a Disaster Response Team within hours of the first plane strike. On September 12th, the Federal Emergency Management Agency (FEMA) and its contractor, Greenhorne and O'Mara, Inc., located in Greenbelt, Maryland, commenced the development of a Building Performance Assessment Team (BPAT; explained more fully on the next page) to conduct a formal analysis of the progressive collapses and produce a report of its findings. A variety of other engineering researchers and professionals, including members of the Structural Engineering Association of New York, also engaged in the monumental task of collecting data that could lead to a better understanding of the collapse of the buildings themselves and to the development of mitigation strategies to prevent a similar tragedy in the future.

Concerns Related to the Engineering Investigation

Though many of the individuals who have participated in the WTC building performance investigation are architects and engineers with experience investigating other structural collapses—including those resulting from natural causes as well as terrorist attacks—nothing had prepared these investigators for a disaster of this magnitude and complexity. Unlike the destruction caused by an earthquake, which may affect several buildings across an expansive area, this disaster involved many buildings and a massive debris pile in a small, confined area. Also unlike most earthquakes, the WTC disaster caused significant casualties and prompted a prolonged search and rescue effort. In addition, the concurrent criminal investigation by the Federal Bureau of Investigation and a separate investigation by the National Transportation Safety Board further frustrated the building performance investigators.

The investigation has been hampered by a number of issues, including:

- *No clear authority and the absence of an effective protocol for how the building performance investigators should conduct and coordinate their investigation with the concurrent search and rescue efforts, as well as any criminal investigation:* Early confusion over who was in charge of the site and the lack of authority of investigators to impound pieces of steel for examination before they were recycled led to the loss of important pieces of evidence that were destroyed early during the search and rescue effort. In addition, a delay in the deployment of FEMA's BPAT team may have compounded the lack of access to valuable data and artifacts.
- *Difficulty obtaining documents essential to the investigation, including blueprints, design drawings, and maintenance records:* The building owners, designers and insurers, prevented independent researchers from gaining access—and delayed the BPAT team in gaining access—to pertinent building documents largely because of liability concerns. The documents are necessary to validate physical and photographic evidence and to develop computer models that can explain why the buildings failed and how similar failures might be avoided in the future.
- *Uncertainty as a result of the confidential nature of the BPAT study:* The confidential nature of the BPAT study may prevent the timely discovery of potential gaps in the investigation, which may never be filled if important, but ephemeral evidence, such as memories or home videotapes, are lost. The confidentiality agreement that FEMA requires its BPAT members to sign has frustrated the efforts of independent researchers to understand the collapse, who are unsure if their work is complementary to, or duplicative of, that of the BPAT team. In addition, the agreement has prevented the sharing of research results and the ordinary scientific give-and-take that otherwise allows scientists and engineers to winnow ideas and strengthen results.
- *Uncertainty as to the strategy for completing the investigation and applying the lessons learned:* The BPAT team does not plan, nor does it have sufficient funding, to fully analyze the structural data it collected to determine the reasons for the collapse of the WTC buildings. (Its report is expected to rely largely on audio and video tapes of the event.) Nor does it plan to examine other important issues, such as building evacuation mechanisms. Instead, FEMA has asked the National Institute of Standards and Technology (NIST) to take over the investigation. Yet so far, NIST has not released a detailed plan describing how it will take over the investigation, what types of analyses it will conduct, how it will attempt to apply the lessons it learns to try to improve building and fire codes, and how much funding it will require.

Role of the Federal Emergency Management Agency

The Federal Emergency Management Agency is charged with supporting the Nation's emergency management system. FEMA intervenes at all stages of disaster management including preparation, response, recovery, mitigation, risk reduction, and prevention. In the case of the World Trade Center attack, FEMA dispatched Urban Search and Rescue Teams and established a disaster field office at the site within hours of the first strike to assist in New York City's rescue effort. At the same time, the FEMA Building Performance Assessment Team (BPAT) began their important work of initiating an analysis that could ultimately yield valuable information about the sequence of events and failures that resulted in progressive building collapse.

BPATs are routinely deployed by FEMA following disasters caused by events such as floods and hurricanes. The teams are formed by, and operate under the direction of the Mitigation Directorate's Program Assessment and Outreach Division and comprise such individuals as regional FEMA staff, representatives from state and local governments, consultants who are experts in engineering, design, construction, and building codes, and other technical and support personnel. A contractor for FEMA, Greenhorne & O'Mara, Inc., maintains a roster of hundreds of mitigation specialists from across the United States. BPAT teams are typically deployed within seven days of any disaster event.

Generally, a BPAT conducts field inspections and technical evaluations of buildings to identify design practices, construction methods, and building materials that either failed or were successful in resisting the forces imposed by the event. A major objective of the BPAT's findings and recommendations are aimed at improving design, construction and enforcement of building codes to enhance performance in future disasters. The culmination of the BPAT's efforts is a report that presents the team's observations, conclusions, and recommendations for improving building performance in future natural disasters.

The BPAT team deployed to the WTC site was assembled by the American Society of Civil Engineers and is headed by W. Gene Corley, Ph.D., P.E, Senior Vice President of Construction Technologies Laboratory in Skokie, Illinois. He was also the principal investigator in the FEMA study of Oklahoma City's Murrah Federal Office Building. On September 11th, ASCE, in partnership with a number of other professional organizations, commenced the formation of an independent team of experts to conduct a building performance assessment study at the WTC site as part of ASCE's Disaster Response Procedure. In late September, this team, the ASCE Disaster Response team, was officially appointed as the BPAT team and was funded by FEMA to assess the performance of the buildings and report its findings. The BPAT team received $600,000 in FEMA funding in addition to approximately $500,000 in ASCE in-kind contributions.

The 23-member BPAT team conducted an analysis of the wreckage on-site, at Fresh Kills Landfill and at the recycling yard from October 7–12, 2001, during which the team extracted samples from the scrap materials and subjected them to laboratory analysis. Why the analysis was conducted only after a delay of three weeks after the attacks remains unclear. Since November, members of the Structural Engineers Association of New York (SEAoNY) have volunteered to work on the BPAT team's behalf and are visiting recycling yards and landfills two to three times a week to watch for pieces of scrap that may provide important clues with regard to the behavior of the buildings.

In the month that lapsed between the terrorist attacks and the deployment of the BPAT team, a significant amount of steel debris—including most of the steel from the upper floors—was removed from the rubble pile, cut into smaller sections, and either melted at the recycling plant or shipped out of the U.S. Some of the critical pieces of steel—including the suspension trusses from the top of the towers and the internal support columns—were gone before the first BPAT team member ever reached the site. Fortunately, an NSF-funded independent researcher, recognizing that valuable evidence was being destroyed, attempted to intervene with the City of New York to save the valuable artifacts, but the city was unwilling to suspend the recycling contract. Ultimately, the researcher appealed directly to the recycling plant, which agreed to provide the researcher, and ultimately the ASCE team and the SEAoNY volunteers, access to the remaining steel and a storage area where they could temporarily store important artifacts for additional analysis. Despite this agreement, however, many pieces of steel still managed to escape inspection.

The BPAT team is expected to release its report in April. Because FEMA requires the members of its BPAT team to sign a confidentiality agreement until the report is released, the exact scope of the report is unknown. But it appears from the role that BPAT teams normally play and general comments ASCE members of the BPAT team have made that the report is likely to include an examination of how the buildings behaved leading up to the collapse, hypotheses for which structural elements failed and thereby initiated the collapse, and recommendations for additional research and analysis.

For example, ASCE has said that the study will rely primarily on audio and video recordings, interviews with survivors, blueprints and design drawings of the World Trade Center, and evidence they or the SEAoNY volunteers have collected from the rubble. The BPAT team has access to more than 120 hours of high quality film footage and audiotapes of 911 communications with trapped victims. The BPAT team initially had difficulty in obtaining building blueprints and design drawings from either the City of New York, the Port Authority, the building owners, or the building designers due primarily to liability concerns on the part of the building owners and insurers. Belatedly, however, the team was provided access to these documents in early January.

ASCE has said that the BPAT study will not include an analysis of the evacuation or rescue procedures and may not be able to validate definitively any of a number of hypotheses regarding the collapse. But because of the confidentiality of the report, it is unclear whether the it will provide answers or simply lay out more questions. It is unknown, for example, to what degree the BPAT report will compare video evidence with that collected from the steel beams from the floors that were hit by the planes.

As a result, independent researchers are unsure how they can contribute to the understanding of how the buildings fell without unnecessarily duplicating work. Others fear that the BPAT's silence on the scope of its report may allow critical aspects of the picture to be missed, and that, by the time the report is released and any such gaps are discovered, the trail of evidence that could provide answers may have grown cold.

The National Science Foundation

Researchers supported by the National Science Foundation are used to mobilizing rapidly after an earthquake and arriving on scene soon after the event to begin collecting data. Recognizing the similarities between the WTC disaster and earthquakes, NSF program managers awarded nearly $300,000 to experienced earthquake researchers, including engineers and social scientists, to begin an analysis of the 9/11 terrorist attacks within 72 hours of the events. In an effort to quickly deploy researchers to the site, awards were made through the Small Grants for Exploratory Research Program, a supplemental award program that enables NSF program managers to award additional support to currently-funded investigators through an abbreviated internal review process (see *Appendix B* for a list of awards).

The efforts of NSF-funded researchers were impeded by the same obstacles the BPAT team encountered: an inability to examine the steel, either removed from the site during the early search and rescue work or shipped to recycling plants, and the denial of access to building design, construction and maintenance documents. Interestingly, it was an NSF-funded researcher who ultimately negotiated the arrangements by which he and others investigating the disaster were provided access to the remaining pieces of steel at the recycling plant.

To date, the NSF-funded researchers continue to face problems. They continue to be denied access to important building diagrams and blueprints, and so are unable to complete their analyses or develop the computer models necessary to better understand the failure of the buildings structural elements. Perhaps more importantly, without these computer models, engineering researchers will be unable to develop effective mitigation strategies.

The National Institute of Standards and Technology

NISTs Building and Fire Research Laboratory carries out research in fire science, fire safety engineering, and structural, mechanical, and environmental engineering. It is the only federal laboratory dedicated to research on building design and fire safety. In the past, the lab has investigated several structural failures using authority Congress made explicit in 1985 (15 U.S.C. 282a). The goals of its previous investigations were to determine the probable technical causes of the failures, examine what lessons could be learned from those determinations, and help develop improved building codes, standards, and practices. The investigations also identified areas of research that needed further study.

Shortly after the attack, NIST appointed an employee of the Building and Fire Research Laboratory to serve on the 23-member BPAT team. While this partnership lent some of NIST's resources and expertise to the BPAT study, NIST did not immediately launch a formal investigation into the technical causes that led to the collapse of the World Trade Center buildings.

NIST believes that the World Trade Center collapse raises difficult and technical questions regarding building codes and standards, justifying the redirection of funds to its building and fire lab. For example, standards for concrete design, building loads, and structural integrity may need revision. In response, NIST has redirected $2 million of its fiscal year 2002 internal discretionary funds to the lab to supplement its current building engineering and standards work. NIST has also requested permission to reprogram from the rest of its laboratories another $2 million in fiscal year 2002 funds for these efforts. The reprogramming request is currently pending before the Office of Management and Budget and will ultimately need approval from Congress. NIST did not need Congressional review to redirect its discretionary funds.

In January, after a delay of three months since the terrorists' attacks, FEMA asked NIST to take over the next phase of the investigation of the collapse. Yet neither NIST nor FEMA has released details as to what that next phase would entail (other than the general outline NIST has provided below). In addition, the Administration has not yet indicated whether FEMA, NIST, or a supplemental funding request to Congress would provide funds for such an investigation, nor has it identified how much it would cost.

Administration officials and outside parties are weighing whether a formal arrangement should be made for NIST to serve as FEMA's research arm in the event of future catastrophic building failures. Currently, there is no formal relationship between the two agencies regarding these matters.

Based on some initial planning, NIST has preliminarily identified the following general areas for investigation:

- Determine technically, why and how the buildings collapsed (WTC 1 and 2, and possibly WTC 7);
- Investigate the technical aspects of fire protection, response, and evacuation, and occupant behavior and response;
- Determine whether state-of-the-art procedures were used in the design, construction, operation, and maintenance of the WTC building;
- Determine whether there are new technologies and procedures emerging that could be employed in the future to reduce the potential risks of collapse; and
- Identify building and fire codes, standards, and practices that warrant revision.

3. Questions

Please see *Appendix A* for copies of letters to witnesses and the questions each was asked to address in testimony at the hearing.

4. Witnesses

The following witnesses will address the Committee:

Mr. Robert Shea, Acting Administrator Federal Insurance and Mitigation Administration, and, Mr. Craig Wingo, Director of Division of Engineering Science and Technology, Federal Emergency Management Administration

Dr. W. Gene Corley, P.E., S.E., American Society of Civil Engineers, Chair of the Building Performance Assessment Team reviewing the WTC disaster

Professor Glenn Corbett, Assistant Professor of Fire Science at John Jay College, New York City

Dr. Abolhassan Astaneh-Asl, Professor, Department of Civil and Environmental Engineering, University of California, Berkeley

Dr. Arden Bemet, Director, National Institute of Standards and Technology

5. Appendices

Appendix A—Letters and Questions to Witnesses
Appendix B—NSF Small Grants for Exploratory Research Awards
Appendix C—Building Design and Collapse Scenarios
Appendix D—Additional Reading

Appendix A
Letters and Questions to Witnesses:

February 20, 2002

Mr. Joe Allbaugh, Director
Federal Emergency Management Agency
500 C Street, S.W.
Washington, D.C. 20472

Dear Mr. Allbaugh:

The Science Committee of the U.S. House of Representatives will hold a hearing entitled "Learning from 9/11: Understanding the Collapse of the World Trade Center" on February 26, 2002 at 2:30 PM in 2175 of the Rayburn House Office Building. I would like to request your presence, or that of your designee, to testify at this hearing.

The Committee's hearing will focus on understanding the nature of the post-disaster reconnaissance response to the World Trade Center (WTC) attacks. Your verbal testimony should address the following questions:

- Describe FEMA's role in investigating the collapse with particular attention to answering these questions: (1) What has FEMA done to ensure that a range of researchers have had access to the WTC site? (2) Have conflicts arisen between the BPAT and other researchers and how has FEMA responded?
- What effects have impediments such as the loss of materials from the site and the delay in obtaining access to the blueprints for the World Trade Center buildings had on the progress of the investigation? How has FEMA responded to these impediments?
- Should the protocols for investigations such as these be changed in order to deal with similar impediments in the future? If so, what changes would FEMA recommend?
- Does FEMA have policies in place to govern its cooperation with other Federal agencies in the wake of building failures? How did FEMA decide what role agencies like NIST and NSF should play at the world trade center?
- Has the confidential nature of the BPAT investigation made it more difficult to gain access to materials that might be useful in the investigation, such as private videotapes?

In order to allow sufficient time for questions at the hearing, you should highlight the most significant points of your testimony in an oral presentation of no more than five minutes. Your written statement may be as extensive as you wish and will be included in the hearing record in its entirety. Oral statements and answers to questions will be printed as part of the verbatim record of the hearing; only transcription errors will be edited.

Witnesses testifying before the Committee on Science must observe procedures governing witness testimony. Please see the attached one page description of these requirements and note the timing required for materials submission. Regarding the hardcopies of testimony requested, we encourage you to attach your biography at the back of your testimony, double side your copies when possible to conserve paper, and submit these documents as early as possible.

Materials that may be E-mailed or sent by facsimile may be sent to mary.derr@mail.house.gov or faxed to her attention at 202/225-4438. Please call Mary Derr at 202/225-8844 to discuss delivery of hard copies of testimony.

In addition, if you wish to use the Committee's multimedia facilities, a description of which I've enclosed, please contact Mary Derr at 202/225-8844. My staff can usually accommodate most requests with 72 hours notice.

If you have any questions concerning your appearance before the Committee on Science, please contact Cameron Wilson or Diane Jones of the Committee staff at 202/225-8844 and 225-7815 respectively. I look forward to your participation in the hearing.

Sincerely,

Sherwood L. Boehlert
Chairman
House Science Committee

February 19, 2002

Dr. W. Gene Corley
Senior Vice President
Construction Technologies Laboratories
c/o American Society of Civil Engineers
1015 15th Street, N.W.
Suite 600
Washington, D.C. 20005-2605

Dear Dr. Corely:

The Science Committee of the U.S. House of Representatives will hold a hearing entitled "Learning from 9/11: Understanding the Collapse of the World Trade Center" on February 26, 2002 at 2:30 PM in 2175 of the Rayburn House Office Building. I would like to request your presence to testify at this hearing.

The Committee's hearing will focus on understanding the nature of the post-disaster reconnaissance response to the World Trade Center (WTC) attacks. Your verbal testimony should address the following questions:

- What role did your society play in investigating the collapse of the WTC buildings, and what is the timeline of your review?
- Please describe the impediments your team encountered during the investigation of the collapse of the WTC buildings, such as the loss of material from the WTC site and any effects of such impediments on the report that your team is preparing.
- Should the Federal Emergency Management Agency (FEMA) and/or Congress develop a more comprehensive protocol for how to conduct investigations in response to natural disasters and/or terrorist attacks?
- How can the efforts to determine the exact sequence of events that led to a progressive collapse of the buildings be used to improve building practices, standards, and codes?

In order to allow sufficient time for questions at the hearing, you should highlight the most significant points of your testimony in an oral presentation of no more than five minutes. Your written statement may be as extensive as you wish and will be included in the hearing record in its entirety. Oral statements and answers to questions will be printed as part of the verbatim record of the hearing; only transcription errors will be edited.

Witnesses testifying before the Committee on Science must observe procedures governing witness testimony. Please see the attached one page description of these requirements and note the timing required for materials submission. Regarding the hardcopies of testimony requested, we encourage you to attach your biography at the back of your testimony, double side your copies when possible to conserve paper, and submit these documents as early as possible. Please also remember to send us a letter of financial disclosure, as outlined in the attached document.

Materials that may be E-mailed or sent by facsimile may be sent to mary.derr@mail.house.gov or faxed to her attention at 202/225-4438. Please call Mary Derr at 202/225-8844 to discuss delivery of hard copies of testimony.

In addition, if you wish to use the Committee's multimedia facilities, a description of which I've enclosed, please contact Mary Derr at 202/225-8844. My staff can usually accommodate most requests with 72 hours notice.

If you have any questions concerning your appearance before the Committee on Science, please contact Cameron Wilson or Diane Jones of the Committee staff at 202/225-8844 and 225-7815 respectively. I look forward to your participation in the hearing.

Sincerely,

Sherwood L. Boehlert
Chairman
House Science Committee

February 20, 2002

Mr. Glenn P. Corbett
Assistant Professor of Fire Science
Department of Public Management
John Jay College of Criminal Justice
445 West 59th Street
New York, New York 10019

Dear Mr. Corbett:

The Science Committee of the U.S. House of Representatives will hold a hearing entitled "Learning from 9/11: Understanding the Collapse of the World Trade Center" on February 26, 2002 at 2:30 PM in 2175 of the Rayburn House Office Building. I would like to request your presence to testify at this hearing.

The Committee's hearing will focus on understanding the nature of the post-disaster reconnaissance response to the World Trade Center (WTC) attacks. Your verbal testimony should address the following questions:

- What effects have the loss of materials from the site and the delay in obtaining access to the blueprints for the World Trade Center buildings had on the progress of the investigation?
- Should the Federal Emergency Management Agency (FEMA) and/or Congress develop a more comprehensive protocol for how investigations in response to natural disasters and/or terrorist attacks are conducted, and, if so, what should such a protocol look like?
- What areas of research into the WTC collapse still need to be addressed, and what is the most appropriate way to handle these needs? What are the gaps in our understanding of how fire affects building materials and design, and how can we best fill those gaps?
- Given what we have learned to date about the cause of the collapse of the World Trade Center Buildings, should building practices, standards, and codes be improved? If so, how should the results of the investigations into the collapse of the building be used to improve them?

In order to allow sufficient time for questions at the hearing, you should highlight the most significant points of your testimony in an oral presentation of no more than five minutes. Your written statement may be as extensive as you wish and will be included in the hearing record in its entirety. Oral statements and answers to questions will be printed as part of the verbatim record of the hearing; only transcription errors will be edited.

Witnesses testifying before the Committee on Science must observe procedures governing witness testimony. Please see the attached one page description of these requirements and note the timing required for materials submission. Regarding the hardcopies of testimony requested, we encourage you to attach your biography at the back of your testimony, double side your copies when possible to conserve paper, and submit these documents as early as possible. Please also remember to send us a letter of financial disclosure, as outlined in the attached document.

Materials that may be E-mailed or sent by facsimile may be sent to mary.derr@mail.house.gov or faxed to her attention at 202/225-4438. Please call Mary Derr at 202/225-8844 to discuss delivery of hard copies of testimony.

In addition, if you wish to use the Committee's multimedia facilities, a description of which I've enclosed, please contact Mary Derr at 202/225-8844. My staff can usually accommodate most requests with 72 hours notice.

If you have any questions concerning your appearance before the Committee on Science, please contact Cameron Wilson or Diane Jones of the Committee staff at 202/225-8844 and 225-7815 respectively. I look forward to your participation in the hearing.

Sincerely,

Sherwood L. Boehlert
Chairman
House Science Committee

February 28, 2002

Abolhassan Astaneh-Asl, Ph.D.
Professor
Department of Civil and Environmental Engineering
University of California, Berkeley
Berkeley, CA 94720-1710

Dear Dr. Astaneh-Asl:

The Science Committee of the U.S. House of Representatives will hold a hearing entitled "Learning from 9/11: Understanding the Collapse of the World Trade Center" on March 6, 2002 at 12:00 PM in 2318 of the Rayburn House Office Building. I would like to request your presence to testify at this hearing.

The Committee's hearing will focus on understanding the nature of the post-disaster reconnaissance response to the World Trade Center (WTC) attacks. Your verbal testimony should address the following questions:

- What role did you play in the investigating the collapse of the WTC buildings and what do you expect to produce from your effort? How did you arrange NSF funding for your work, and how was that arranged so quickly?
- Please describe the impediments that you encountered during the investigation of the collapse of the WTC buildings, such as the loss of material from the WTC site and any effects of such impediments on your work.
- Should the Federal Emergency Management Agency (FEMA) and/or Congress develop a more comprehensive protocol for how to conduct investigations in response to natural disasters and/or terrorist attacks?
- What areas of research into the WTC collapse still need to be addressed, and what is the most appropriate way to handle these needs?
- Has the confidential nature of the FEMA's Building Performance Assessment Team investigation made it more difficult to gain access to materials that might be useful, such as private videotapes?

In order to allow sufficient time for questions at the hearing, you should highlight the most significant points of your testimony in an oral presentation of no more than five minutes. Your written statement may be as extensive as you wish and will be included in the hearing record in its entirety. Oral statements and answers to questions will be printed as part of the verbatim record of the hearing; only transcription errors will be edited.

Witnesses testifying before the Committee on Science must observe procedures governing witness testimony. Please see the attached one page description of these requirements and note the timing required for materials submission. Regarding the hardcopies of testimony requested, we encourage you to attach your biography at the back of your testimony, double side your copies when possible to conserve paper, and submit these documents as early as possible. Please also remember to send us a letter of financial disclosure, as outlined in the attached document.

Materials that may be E-mailed or sent by facsimile may be sent to mary.derr@mail.house.gov or faxed to her attention at 202/225-4438. Please call Mary Derr at 202/225-8844 to discuss delivery of hard copies of testimony.

In addition, if you wish to use the Committee's multimedia facilities, a description of which I've enclosed, please contact Mary Derr at 202/225-8844. My staff can usually accommodate most requests with 72 hours notice.

If you have any questions concerning your appearance before the Committee on Science, please contact Cameron Wilson or Diane Jones of the Committee staff at 202/225-8844 and 225-7815 respectively. I look forward to your participation in the hearing.

Sincerely,

Sherwood L. Boehlert
Chairman
House Science Committee

February 20, 2002

Dr. Arden L. Bement, Jr.
Director
National Institute of Standards and Technology
100 Bureau Drive
Stop 1000
Gaithersburg, MD 20899

Dear Dr. Bement:

The Science Committee of the U.S. House of Representatives will hold a hearing entitled "Learning from 9/11: Understanding the Collapse of the World Trade Center" on February 26, 2002 at 2:30 PM in 2175 of the Rayburn House Office Building. I would like to request your presence to testify at this hearing.

The Committee's hearing will focus on understanding the nature of the post-disaster reconnaissance response to the World Trade Center (WTC) attacks. Your verbal testimony should address the following questions:

- What does National Institute of Standards and Technology (NIST) see as its role in the investigation of building collapses, and is this role codified in any document or agreement?
- What role did it play before being asked by the Federal Emergency Management Agency (FEMA) to take over the investigation of the collapse of the WTC buildings? Why hadn't NIST played a larger role previously?
- What are the goals of NIST's new investigation and what specific steps will it take to meet them? To what extent will the loss of material from the site hinder to the new investigation?
- How can our efforts to determine the exact sequence of events that led to a progressive collapse of the buildings be used to improve building practices, standards, and codes?
- What are the gaps in our understanding of how fire affects building materials and design, and what needs to be done to fill those gaps?

In order to allow sufficient time for questions at the hearing, you should highlight the most significant points of your testimony in an oral presentation of no more than five minutes. Your written statement may be as extensive as you wish and will be included in the hearing record in its entirety. Oral statements and answers to questions will be printed as part of the verbatim record of the hearing; only transcription errors will be edited.

Witnesses testifying before the Committee on Science must observe procedures governing witness testimony. Please see the attached one page description of these requirements and note the timing required for materials submission. Regarding the hardcopies of testimony requested, we encourage you to attach your biography at the back of your testimony, double side your copies when possible to conserve paper, and submit these documents as early as possible. Please also remember to send us a letter of financial disclosure, as outlined in the attached document.

Materials that may be E-mailed or sent by facsimile may be sent to mary.derr@mail.house.gov or faxed to her attention at 202/225-4438. Please call Mary Derr at 202/225-8844 to discuss delivery of hard copies of testimony.

In addition, if you wish to use the Committee's multimedia facilities, a description of which I've enclosed, please contact Mary Derr at 202/225-8844. My staff can usually accommodate most requests with 72 hours notice.

If you have any questions concerning your appearance before the Committee on Science, please contact Cameron Wilson or Diane Jones of the Committee staff at 202/225-8844 and 225-7815 respectively. I look forward to your participation in the hearing.

Sincerely,

Sherwood L. Boehlert
Chairman
House Science Committee

Appendix B

NSF Small Grants for Exploratory Research Awards made in response to the events of September 11, 2001.

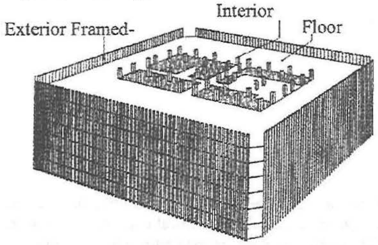
- $100,000 to the Multidisciplinary Center for Earthquake Engineering Research at SUNY Buffalo (in partnerships with the University of Delaware) to conduct structural analysis of damaged but standing buildings and to conduct social science research of human response in the context of disasters;
- $45,000 to the University of Florida (in partnership with NOAA) to assess infrastructure damage utilizing land-based laser swath mapping technology;
- $20,000 to Georgia Tech to develop digital data collection technology for damage assessment;
- $15,000 to University of California Berkeley to conduct post-disaster structural engineering data collection;
- $15,000 to University of Maryland to conduct fire analysis at the WTC site;
- $25,000 to George Washington University to observe and document the inter-organizational response to the terror attacks (and later the anthrax dispersal);
- $70,000 to Rennesalear Polytechnic Institute for research on critical infrastructure interdependence; and
- $10,000 to University of Colorado Boulder to provide support to a number of social scientists associated with the Natural Hazards Research Application and Information Center

Appendix C

Building Design and Collapse Scenarios

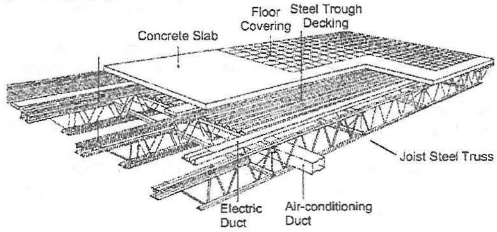
The World Trade Center towers were designed and constructed in the late 1960s using what were considered groundbreaking design and construction methods at the time. Most high-rise buildings, such at the Empire State Building, were designed using a skeleton frame structure of welded or riveted steel columns and beams, often encased in concrete. In this design, the columns carry the load of the building while the external wall carries little, if any, of the loads.

Diagram of WTC Design



To reach the spectacular heights that the World Trade Center architects envisioned, the engineers came up with a radically different design frequently called a "tube" structure. The key to this design lay in the use of closely spaced high-strength vertical steel columns connected by horizontal beams along the outer faces of the building. This matrix constituted a rigid, but flexible outer tube structure designed to resist the forces from the high winds that plague tall buildings in New York City. The design also consisted of a massive hollow internal steel column that supported most of the gravity load of the building, in addition to housing the stairwells, elevator shafts, and bathrooms. The final element were the lightweight floors, which connected the internal and external parts of the building and each typically consisted of four inches of concrete poured over steel decking and laid upon lightweight steel trusses. The trusses were attached to steel seats at both the interior and exterior columns. This revolutionary design not only allowed the building to withstand high winds and reach a previously unattainable 110 stories, but it also allowed for large open-spaced floors – providing a total of about 10 million square feet of commercial space in the two buildings.

Diagram of Lightweight Floors



The research community is actively exploring three predominate hypotheses as to the exact sequence of events that led to the progressive collapse of the towers. The first hypothesis is that fire weakened the floor trusses that connected the exterior and interior columns, causing the trusses to sag and eventually separate from the external walls. The external columns, without the trusses to provide lateral restraint, then buckled and caused the buildings to collapse. The second hypothesis is that initial impact of the planes was so great the towers were on the verge of collapsing when the fire weakened the external columns, causing them to buckle and collapse. The third hypothesis is that the initial impact caused the weight of the upper floors of the building to be shifted from the exterior to the interior columns (through trusses on top of the towers). The overload damaged the interior columns, which failed and caused the building to collapse.

Copyright 2001 The New York Times Company
The New York Times

December 4, 2001, Tuesday, Late Edition - Final

SECTION: Section F; Page 1; Column 2; Science Desk

LENGTH: 1883 words

HEADLINE: Wounded Buildings Offer Survival Lessons

BYLINE: By JAMES GLANZ

BODY:

At some indefinable hour during an interminable night, the fires that had raged for nearly two days in the skyscraper at 90 West Street still puffed and flared when Derek Trelstad, a structural engineer, walked into the building and cautiously began climbing the stairs, the double snout of his respirator wheezing in the haze.

Charred wreckage dangling from the ceilings and heaped on the floors cast strange shadows in the light streaming from rescue equipment outside through punched-out windows on the building's northern facade. On Sept. 11, flaming steel debris from the south trade tower had smashed against the thick terra cotta of that facade and started the fire within. "It was like the ultimate haunted house," said Mr. Trelstad, a senior project director at LZA/Thornton-Tomasetti in Manhattan, a firm that is helping the city evaluate the structural soundness of buildings around the disaster site.

But Mr. Trelstad soon made remarkable discoveries by looking behind the burnt wreckage, examining the building's vintage steel structure and the archaic, tile fireproofing materials that protected much of it.

He found that except for a few spots where structural columns had slightly buckled on the upper floors, the building, a 1907 landmark designed by Cass Gilbert, had battled the fire and essentially won.

The building had avoided the fate of 7 World Trade Center, the 47-story skyscraper on the northern edge of ground zero whose collapse in a fire on Sept. 11 has emerged as a mystery. Moreover, the 1907 high-rise could also be refurbished and occupied.

As engineers widened their survey of surviving but severely damaged buildings on the rim of ground zero, they realized that they had uncovered an engineering clinic of sorts, one that might provide a rare positive note within the zone of devastation.

Investigations of how and why those buildings survived could lead to improvements in the way skyscrapers and other structures are built. Experts said early indications that older buildings performed better than newer ones were still difficult to confirm, partly because the buildings had been under different stresses during the attacks.

But they said a reconsideration of some bygone building practices would be an almost certain consequence of the new information.

"Engineers can take it as an accidental experiment, or a 'found experiment,' " said Dr. Henry Petroski, a professor of civil engineering at Duke University and the author of "Design Paradigms: Case Histories of Error and Judgment in Engineering" (Cambridge, 1994).

The lessons around ground zero go well beyond protecting against fire. On a purely structural level, debris from the south trade tower raked down the front of the Bankers Trust Building, a 40-story high-rise built in the 1970's, and knocked out 11 stories of a major steel column in its facade. But not even the portions of floors immediately above the gash collapsed.

Likewise, steel members from one of the towers were hurled westward like spears and lodged in one corner of the American Express tower, knocking out a structural column along three floors but producing no secondary collapse. Debris from 7 World Trade sheared off parts of two adjacent structures -- the Verizon Building and a City University of New York building -- which also remained standing.

Because the structures had not been built with such an attack in mind, engineers said, their survival was a side effect of design elements put in place for other reasons. But as studies isolate those elements, they could become part of common engineering practice and perhaps even be mandated in new municipal building codes, the engineers said.

"I think we will start seeing some of that coming into our codes, or at a minimum, engineering practice," said Richard Tomasetti, president of LZA/Thornton-Tomasetti. "We're going into a new era."

While no one advocates a return to the design principles of a century ago, the engineers who have examined the still-graceful high-rise at 90 West Street say it may carry some important lessons for the streamlined skyscrapers of today.

Built five years before Mr. Gilbert's more famous F. W. Woolworth Company Building, which happens to overlook ground zero from the northeast and was undamaged in the attacks, 90 West Street has a Gothic facade made of two layers of terra cotta totaling more than a foot in thickness.

The building originally boasted a top-floor establishment that billed itself as the highest restaurant in New York, according to the city's Landmarks Preservation Commission -- a curious parallel with Windows on the World in the north trade tower.

When the south tower collapsed, said Mr. Trelstad, the engineer, some of its huge columns fell and ripped out many of the steel spandrels, or cross beams between windows, on the north facade of 90 West Street. One series of spandrels, from the 11th down to the 3rd floors on the east part of the facade, was destroyed as if a giant claw had run down the front of the building.

Whether because the heavy terra cotta acted like armor or because some of the blows were glancing, none of the vertical steel columns holding up the building were damaged in the south tower's collapse. But it was not until Mr. Trelstad ventured inside that he fully appreciated the building's resilience.

He was first struck by the scale of the devastation and the eeriness of the setting. Fires set by the south tower's debris had gutted the 2nd, 3rd, 10th and 23rd floors, and much of the northern portions of the 4th, 5th, 8th and 21st floors. At least two people are believed to have died in the building, trapped in an elevator.

As if that were not sobering enough, during his second visit, several men who Mr. Trelstad did not know were in the building suddenly ran screaming down a stairway from the roof, saying they had been radioed that another nearby tower was about to collapse.

"There was that heightened sense of awareness that everywhere you look, you're afraid you're going to see something you don't want to see," Mr. Trelstad said.

Instead, what he observed soon lifted his spirits a bit. Both fire stairwells had been surrounded by four to six inches of heavy tile fireproofing and were virtually untouched by the blaze. Most of the dozens of steel columns holding up the building were encased in four-inch-thick blocks of tile much like the material of which flower pots are made.

Except for four places on the upper floors where columns had softened and bent slightly in the heat, the heavy tile had done its job and protected the steel. And even though that kind of tile can be brittle, columns in the facade that had been exposed by the impact of debris still had their fireproofing in place.

Fireproofing in the floors was still more impressive, with an archlike arrangement of tile a foot thick having stopped the flames from burning through one story to the next.

The cost and installation of such tile today would probably be prohibitive, Mr. Trelstad said, but the new evidence could lead to a reassessment of the lightweight fireproofing used in modern skyscrapers like 7 World Trade Center.

Engineers said that any direct comparison between 7 World Trade, which was also set on fire by falling debris but then collapsed, and 90 West was fraught with difficulties. For one thing, the conditions the two buildings initially faced on Sept. 11 were not clear.

For another, the recent discovery that 7 World Trade held tens of thousands of gallons of diesel fuel to power electrical generators in the event of a power failure has set off a debate among engineers over whether there may have been extraordinarily hot conditions that softened the steel and led to the collapse.

But with that debate unresolved, engineers said, the collapse remains one of the deepest mysteries their profession has faced. No other modern, steel-reinforced skyscraper -- except for the trade towers themselves -- has ever collapsed in a fire.

Moreover, 7 World Trade did not have the lightweight steel trusses holding up its floors that may have been the first elements to soften and fail in the trade towers. Instead, said Silvian Marcus, executive vice president for the Cantor Seinuk Group and a structural engineer involved in the original design of the building, the floors were supported by sturdy I-beams.

Irwin Cantor, one of the original structural engineers for the building but no longer affiliated with Cantor Seinuk, said, "There's something that doesn't compute."

"That's why up to this minute, nobody in the engineering profession is ready to say to you, 'I know what made that building come down,'" added Mr. Cantor, who is now a consulting engineer and a commissioner in the Department of City Planning.

Although Mr. Cantor said he believed the diesel fuel played a role in the collapse, he said it was also likely that fireproofing in 7 World Trade, which was completed in 1987, was damaged in the impacts caused by falling debris.

That fireproofing was of a type used in virtually all modern, steel-reinforced buildings: a melange of mineral fibers and concrete-like materials called binders that make the fireproofing sticky. Sprayed onto steel in layers that are often less than an inch thick, the material insulates well in controlled, laboratory tests, which generally involve sedate fires in large ovens.

But the material is so soft and friable that it can be removed with a putty knife even after it has been in place for years. In the chaos of any terrorist attack involving a blast or an impact, many engineers have said, the material can easily be knocked off the steel, leaving it unprotected in a fire.

A return to tile fireproofing is unlikely because of its expense and weight, said Mr. Tomasetti, the LZA/Thornton-Tomasetti president. But he said the new information would almost certainly prompt a drive to improve spray-on fireproofing with chemical additives or other measures.

A managing principal at the firm, Thomas Scarangello, said structural damage to other buildings not involving fire had reinforced an engineering lesson: create structures that are able to redistribute loads spontaneously if part of a building is suddenly destroyed. "All engineers are adding it to their experience list," Mr. Scarangello said of the investigation around the trade center.

Exceptionally robust connections between columns and beams as well as unexpectedly sturdy floor bracing allowed for that sort of rerouting when debris knocked out a structural column in the Bankers Trust Building at 130 Liberty Street, Mr. Scarangello said.

But on a recent day at ground zero, perhaps the most vivid example of that redundancy could be seen at the command center run by Kenneth Holden, commissioner of the Department of Design and Construction, the city agency leading the cleanup.

Mr. Holden's office at the command center is on the 30th floor of the American Express tower, tucked into the southeast corner of the building, a few floors above the spot where steel from the trade towers knocked out a structural column.

"When they told me where my office was," Mr. Holden said, peering out of a corner window, "I felt like a canary in a coal mine."

So far, Mr. Holden said, the office has remained stable.
http://www.nytimes.com

GRAPHIC: Photo: The Bankers Trust Building was damaged by debris from the south tower of the World Trade Center. (James Estrin/The New York Times)(pg. F2)

Drawings (Mika GrRated PG-13ndahl and Bill Marsh/The New York Times)(pg. F1)

Chart: "Two Buildings Burned; Only One Fell"
The collapse of the twin towers touched off fierce fires in 7 W.T.C., built in 1987, and 90 West Street, built 80 years earlier. Why only the older tower stood is an engineering mystery, but construction and fireproofing may hold clues.

7 W.T.C. STRUCTURE
To provide open office areas, load-bearing columns were placed in the center and around the outside of the building.

90 WEST STRUCTURE
A relatively dense arrangement of columns throughout the building helps make it especially rigid.

FIREPROOFING

Columns are surrounded by heavy tile 4-6 inches thick.

FIREPROOFING
Exposed structural steel was covered in a sprayed-on coating, often less than an inch thick. Some of it could have been knocked off by the impact of falling debris.

(Sources: Silvian Marcus, Cantor Seinuk Group; Derek Trelstad, LZA/Thornton-Tomasetti)
(pg. F1)

LOAD-DATE: December 4, 2001

LexisNexis

Copyright 2001 The New York Times Company
The New York Times
December 25, 2001, Tuesday, Late Edition - Final

SECTION: Section A; Page 1; Column 5; Metropolitan Desk

LENGTH: 1645 words

HEADLINE: A NATION CHALLENGED: THE TOWERS;
Experts Urging Broader Inquiry In Towers' Fall

BYLINE: By JAMES GLANZ and ERIC LIPTON

BODY:

Saying that the current investigation into how and why the twin towers fell on Sept. 11 is inadequate, some of the nation's leading structural engineers and fire-safety experts are calling for a new, independent and better-financed inquiry that could produce the kinds of conclusions vital for skyscrapers and future nationwide.

Senator Charles E. Schumer and Senator Hillary Rodham Clinton, both of New York, have joined the call for a wider look into the collapses. In an interview on Friday, Mr. Schumer said he supported a new investigation "not so much to find blame" for the collapse of the buildings under extraordinary circumstances, "but rather so that we can prepare better for the future." "It could affect building practices," he said. "It could affect evacuation practices. We live in a new world and everything has to be recalibrated."

Experts critical of the current effort, including some of those people who are actually conducting it, cite the lack of meaningful financial support and poor coordination with the agencies cleaning up the disaster site. They point out that the current team of 20 or so investigators has no subpoena power and little staff support and has even been unable to obtain basic information like detailed blueprints of the buildings that collapsed.

While agreeing that any building hit by a jetliner would suffer potentially devastating damage, experts want to examine whether the twin towers may have had hidden vulnerabilities that contributed to their collapse.

The lightweight steel trusses that supported the tower's individual floors, the connections between the trusses and the buildings' vertical structural columns, as well as possible flaws in the fireproofing have been drawing scrutiny from fire safety consultants and engineers in recent weeks.

"Two buildings came down," said Joseph F. Russo, director of the Center for Fire Safety Engineering at Polytechnic University in Brooklyn, referring to the twin towers. "That suggests some degree of predictability."

"And if it was predictable," Mr. Russo said, "was it preventable?"

Family members of some victims have added their voices to the calls for a wider investigation.

The exact scope of an expanded inquiry has not been defined. But the central desire is to learn any lessons that might be hidden in the rubble and to pinpoint the exact sequence and cause of the collapse, regardless of whether it was inevitable from the moment the planes struck, members of the investigative team and others said.

In calling for a new investigation, some structural engineers have said that one serious mistake has already been made in the chaotic aftermath of the collapses: the decision to rapidly recycle the steel columns, beams and trusses that held up the buildings. That may have cost investigators some of their most direct physical evidence with which to try to piece together an answer.

Officials in the mayor's office declined to reply to written and oral requests for comment over a three-day period about who decided to recycle the steel and the concern that the decision might be handicapping the investigation.

"The city considered it reasonable to have recovered structural steel recycled," said Matthew G. Monahan, a spokesman for the city's Department of Design and Construction, which is in charge of debris removal at the site.

"Hindsight is always 20-20, but this was a calamity like no other," said Mr. Monahan, who was designated by the mayor's office to respond to questions about the investigation. "And I'm not trying to backpedal from the decision."

Interviews with a handful of members of the team, which includes some of the nation's most respected engineers, also uncovered complaints that they had at various times been shackled with bureaucratic restrictions that prevented them from interviewing witnesses, examining the disaster site and requesting crucial information like recorded distress calls to the police and fire departments.

The investigation, organized immediately after Sept. 11 by the American Society of Civil Engineers, the field's leading professional organization, has been financed and administered by the Federal Emergency Management Agency. A mismatch between the federal agency and senior engineers accustomed to bypassing protocol in favor of quick answers has been identified as a clear point of friction.

"This is almost the dream team of engineers in the country working on this, and our hands are tied," said one team member who asked not to be identified. Members have been threatened with dismissal for speaking to the press.

"FEMA is controlling everything," the team member said. "It sounds funny, but just give us the money and let us do it, and get the politics out of it."

A spokesman for FEMA, John Czwartacki, said the agency's primary mission was to help victims, emergency workers and to speed the city's recovery, and added, "We are not an investigative agency."

But given the assignment to examine the structural failures at the World Trade Center, the agency has so far spent roughly $100,000 and Mr. Czwartacki said that more financing could be expected after the group produced what he called an "interim document" in the spring.

"I've heard the calls for the N.T.S.B.-style investigation," Mr. Czwartacki said, referring to appeals by engineers and some families of trade center victim for an exhaustive examination like those done by the National Transportation Safety Board when a plane crashes. "I don't think this study will do it for them."

Mr. Czwartacki added that it was premature to comment on whether team members were receiving necessary information because the study has not been completed. Regardless of what any investigation might find, it is unclear how many civilian lives would have been saved if the buildings had not collapsed, because so many died on the burning upper floors.

Despite the universe of unknowns, the calls for more extensive investigations of various kinds are coming from engineers, fire experts and professional organizations in New York and across the nation.

"What some of us are calling for is a probe or reassessment," said Loring A. Wyllie Jr., a member of the National Academy of Engineering and chairman emeritus and senior principal at Degenkolb Engineers in San Francisco. Mr. Wyllie, who has investigated many building collapses after earthquakes, said the work would involve "a critique of our building practices" in search of greater safety after Sept. 11.

He added that intensive studies of building failures in disasters like the Northridge earthquake near Los Angeles in 1994 had led to important structural advances.

Calling an intensive new investigation "absolutely necessary," Mr. Russo, of Polytechnic University in Brooklyn, said the expense could be justified by the payoff of better safety in high-rises of the future. Other experts take a still wider view, favoring a study that would look at the implications of the collapses -- a nearby, 47-story building, 7 World Trade Center, also fell on Sept. 11 after burning for most of the day -- for fire codes, building standards and engineering practices across the board.

National organizations charged with addressing building and fire safety issues have sent letters urging the federal government to invest as much as $15 million a year to study the vulnerability of buildings to terrorist attacks and possible changes to fire and safety standards.

"There is an urgent and critical need to determine the lessons to be learned from these events," reads a letter from the American Society of Civil Engineers, dated Nov. 15.

In other disasters, FEMA, the Army Corps of Engineers and other federal agencies have played a more central role in making decisions about cleanup and investigations. But from the start, they found that New York had a degree of engineering and construction expertise unlike any they had encountered.

"They wanted to do a lot of things on their own," said Charles Hess, who is in charge of civil emergency management for the Army Corps. "Which they're very capable of doing."

But during a recovery effort that received worldwide praise, the city made one decision that has been endlessly second-guessed. To deal with nearly 300,000 tons of crumpled steel, the city quickly decided to ship it to scrap recyclers.

Dr. Frederick W. Mowrer, an associate professor in the fire protection engineering department at the University of Maryland, said he believed the decision could ultimately compromise any investigation of the collapses. "I find the speed with which potentially important evidence has been removed and recycled to be appalling," Dr. Mowrer said.

But Mr. Monahan, the City Department of Design and Construction spokesman, pointed out that members of the investigation team were eventually allowed to visit the site and inspect steel at the scrapyards and continue doing so.

Some experts have suggested that the only way to definitively determine the sequence and cause of the collapse is to recover large amounts of steel from the areas near where the planes struck, and possibly reassemble sections of the towers.

Others say such a reconstruction of an entire section might be impractical, but also expressed discomfort with the impediments they said they have faced in their investigation.

For example, three months after the disaster, Ronald Hamburger, an expert in structural analysis at A.B.S. Consulting in Oakland, Calif., and a director of the National Council of Structural Engineers Associations, said he had not even been given access to basic blueprints describing where the steel and other structural elements had been when the World Trade Center was whole.

"I'd like to be able to have a set of the drawings for all of the affected buildings," Mr. Hamburger said. "I don't have that."
http://www.nytimes.com

GRAPHIC: Photo: Twisted beams from the World Trade Center rest in a heap at ground zero. Calls for a broader investigation into the towers' collapse have grown. (Librado Romero/The New York Times)(pg. B6)

LOAD-DATE: December 25, 2001

Copyright 2002 The New York Times Company

The New York Times

January 17, 2002, Thursday, Late Edition - Final

SECTION: Section B; Page 3; Column 6; Metropolitan Desk

LENGTH: 756 words

HEADLINE: U.S. Agency To Take Over Investigation Into **Collapse**

BYLINE: By JAMES GLANZ and ERIC LIPTON

BODY:

A federal agency with vast experience in investigating building **collapses** and other major catastrophes is moving to take over, and significantly expand, the inquiry into the fall of the World Trade Center's twin towers on Sept. 11.

The National Institute of Standards and Technology, which has investigated building failures worldwide as a result of earthquakes, structural flaws and other factors, has recently begun discussions with other federal and city agencies to formally take control of the inquiry. The investigation of the **collapse** has for months been conducted by a group of engineering experts and been overseen by the Federal Emergency Management Agency. But the investigation has been called inadequate by a growing number of experts, politicians and family members of those who died.

Yesterday, officials with FEMA, who have conceded that they do not have much experience in conducting intensive investigations, said that they would welcome turning over major portions of the inquiry to the National Institute of Standards and Technology. "They've indicated to me that they have authority in this area," said Robert Shea, acting administrator of FEMA's federal insurance and mitigation administration. "We obviously would support them."

While it was obvious on Sept. 11 that any high-rise struck by a fuel-laden jetliner would be at risk of catastrophic failure, engineers and fire safety experts say it is still crucial to determine which structures snapped, buckled or otherwise failed and in what order -- all information that could help improve safety in skyscrapers nationwide. Lingering questions about whether the twin towers had any hidden vulnerabilities could also be answered.

The precise scale of the new effort has not yet been determined, but officials involved in the discussions said the intent would be to create a federal entity like the National Transportation Safety Board, which investigates plane crashes. With the bombing in Oklahoma City and the attack on the World Trade Center, the federal government may indefinitely need to be spending more time examining issues like blast damage, the need to evacuate entire office buildings instead of a few floors, and the combined impact of structural damage and large fires, safety experts and government officials said.

Andy Davis, communications director for Senator Ernest F. Hollings, a South Carolina Democrat whose oversight responsibilities include financing for the National Institute of Standards and Technology, said officials at the institute had indicated in discussions on Capitol Hill that the work could cost $10 million to $12 million a year.

A spokesman for the institute, Michael E. Newman, confirmed that his group was "taking all steps to prepare to conduct an investigation into the technical, causal factors that led to the World Trade Center **collapse.**"

The move by the institute to enter the investigation comes as the group of engineers involved in the initial, FEMA-backed inquiry, says that it almost certainly will not be able to explain the structural failures inside the building that led to the fiery **collapse.** Their more modest goal is to describe data that has been collected and then to list theories of why the buildings collapsed and make recommendations for future research.

"Considering the enormity of the information that needs to be digested now and analyzed, they're not likely to be able to have consensus on the sequence of **collapse** events," said John E. Durrant, a team spokesman at the American Society of Civil Engineers, which is working with FEMA in the study.

As to the twin towers, the team is currently considering at least three scenarios, or theories, of what may have taken place in the moments before and during their **collapse:** that the initial impact was so great the towers were already on the verge of **collapse** and the fires tipped them over the edge; that lightweight floors sagged in the heat and tore away from vertical columns on outside walls; and finally that heavy columns in the buildings' cores gave way, leading the building to implode.

Engineering experts nationwide, as well as city officials, said the entry of the National Institute of Standards and Technology into the investigation was encouraging.

Kenneth R. Holden, commissioner of the city's Department of Design and Construction, said the city is prepared to work with the institute to help any inquiry.

"Obviously it makes sense," Mr. Holden said. "We certainly will cooperate to the extent possible."
http://www.nytimes.com

LOAD-DATE: January 17, 2002

Copyright 2002 The New York Times Company

The New York Times

February 2, 2002, Saturday, Late Edition - Final

SECTION: Section B; Page 1; Column 2; Metropolitan Desk

LENGTH: 1659 words

HEADLINE: A Search for Clues In Towers' Collapse;
Engineers Volunteer to Examine Steel Debris Taken to **Scrapyards**

BYLINE: By JAMES GLANZ and ERIC LIPTON

BODY:
Cranes with super magnets toss smashed washing machines, junked cars and rusted train tracks like paper clips. Trucks with tires as tall as an elephant slop through the stinking, oil-fouled mud, dumping new loads with an unceremonious crash.

It is here at this Jersey City **scrapyard**, in front of a different pile of wreckage, that Anamaria Bonilla, a structural engineer, falls to her knees. With the sleeve of her sweatshirt, she rubs furiously at the rusty surface of a 36-foot-long World Trade Center column that has caught her trained eye. As a cluster of other engineers with charts, tape measures and Palm Pilots gather around her, the hint of a code painted onto the steel more than 30 years ago surfaces.

Rolling over almost on her back to seek other markings she knows must be there, Ms. Bonilla slides her head between the underside of the column and the mud and reads aloud what she finds.

"One-oh-one," she says. "The 101st floor," says a fellow investigator, David F. Sharp, after he also squeezes into the gap, confirming the markings Ms. Bonilla found. It was a potentially important discovery, but in part a result of happenstance.

From the moment the two towers collapsed on Sept. 11, engineers and other experts have been struggling to answer the monumental questions of exactly why and how the buildings, designed to sustain a jet impact, completely collapsed. But despite promises of a broad federal investigation, and after weeks of calls from victims' families and others to halt the destruction of the steel that could hold all sorts of clues, the half-heroic, half-comic scenes at the Jersey City **scrapyard** continue to play out.

Small teams of engineers plot slightly mad dashes, like mountain goats, into mounds of steel to claim pieces of tower columns. The engineers time their forays to avoid being crushed. Indeed, Ms. Bonilla made her find while the **scrapyard** workers were on their lunch break.

Through it all, the engineers profess optimism that they are catching and saving what is most useful. But they concede that there is no way of saying for sure; an unknown number of steel columns has been sent off to mills as far away as Asia without ever having been examined or saved.

"What they're doing is extremely noble, ambitious and wonderful and I'm glad somebody is doing that," said Dr. James G. Quintiere, a professor in fire protection engineering at the University of Maryland. But, he added, "the steel, to me, it's almost a foregone conclusion that its gone."

The organizers of the steel recovery effort will not say how many pieces in total have been set aside for future study, saying only that it is more than 100 from among the hundreds of thousands of World Trade Center steel parts. But without a doubt, the teams surveying have made some important discoveries.

The steel column identified last Wednesday by Ms. Bonilla, with its brackets, bolts and two pairs of winglike steel plates still attached, is a potentially critical discovery. It ran three stories from the 98th to the 101st floor on the exterior face of one tower, just above the zones struck by jets laden with fuel. Now that it has been found -- and spray-painted with the word "Save" in florescent orange paint -- tests can be conducted to determine whether heat or stress or some design or material flaw might have let it fail.

Another crumpled steel member set aside at a Keasbey, N.J., **scrapyard** has markings clearly showing that it ran on the east face of the north tower from the 92nd to the 95th floor, in the center of one impact zone. Pieces of steel have also been found that were apparently melted and vaporized not solely because of the heat of fires, but also because of a corrosive contaminant that was somehow released in the conflagrations. And unexpectedly cracked washers in crucial connections in the towers are being closely scrutinized.

The organized steel recovery effort is one piece of a three-tiered investigation. The American Society of Civil Engineers, in coordination with the Federal Emergency Management Agency, has set up a panel of engineering and fire experts who are assembling photographs, witness interviews and other data to try to determine why the towers collapsed. The effort, organized by the Structural Engineers Association of New York, is the team's primary source of raw steel evidence from the site.

Volunteers from the Structural Engineers Association visited ground zero first in early October and identified a handful of steel samples they wanted to save. But it was not until the start of November that three separate teams started to visit the steel yards on a regular basis. Since then, about 40 visits have been made to the three recycling yards and the Fresh Kills Landfill in Staten Island, where some steel is also being sent.

Much of the effort is focused on trying to find steel that was at or above the floors rammed by the hijacked jets. The towers collapsed from the top down and the fires were concentrated in these areas, so the presumption is that the answer to why they fell down should be found by examining the steel from these spots.

When the towers were built, markings were inscribed on the steel columns to indicate their exact positions. But with the damage from the fire and collapse, many of those markings cannot be found. Instead, the engineers measure the width of the steel: the higher it is in the building, the thinner it is. For example, plates that are three-eighths of an inch thick -- used to connect columns -- were used only above the 80th floor.

The engineers, who more typically are in Manhattan offices designing bridges or high rises, visit the **scrapyards** on a sporadic schedule, sometimes taking vacation days to make up for the absences from their regular jobs. The teams -- about 20 people are involved in all -- are made up of a mixture of some of the city's most established structural engineers, like Edward DePaola, a principal at Sevrerud Associates, and younger engineers, like Ms. Bonilla, who works for a California-based engineering company.

Ms. Bonilla, who spent many days on rooftops during her years working as a carpenter before she became an engineer, is one of the most aggressive spotters, bounding into the steel piles even before the others have climbed out of a rusty Chevrolet truck that drives them around the Jersey City **scrapyard,** called Hugo Neu Schnitzer East.

Other members in the group handle the detailed measurements and take photographs of each piece of steel they intend to save. On some expeditions to the yards, not a single piece considered worth saving is identified. On other days, a whole cache of potentially important scraps is found.

"Every day is productive, even if you don't find anything you have a sense that at least you looked," said Mr. DePaola, whose company served as the structural engineer for projects including the Denver International Airport and the Reuters Building at 3 Times Square that recently opened.

Like doctors performing an autopsy after a mysterious death, the evidence these engineers collect is the raw material that after scrutiny in laboratories around the United States could provide the answer and have an impact far beyond the World Trade Center. Even before pieces of recovered steel are sent off to a laboratory for analysis, the samples tell a story to the practiced eye of Ramon Gilsanz, a structural engineer and partner at Gilsanz, Murray, Steficek in Greenwich Village.

On one piece found last month, extremely detailed markings were found: Tower A, 92-95, 252. That means it came from the north tower, between the 92nd and 95th floors, about 30 feet from the southeast corner, on the east face of the building. The plane that struck this building came in at just about this level, but it struck the north face.

This piece, 21 feet long, is mangled and torn at one end and severely chewed up near the center, where there are burn marks and the scumlike whitish remnants of the fireproofing that once clung to the steel. The stubs of brackets that once held up floors still protrude from what had been the interior surface of the columns. Tiny, twisted scraps of the aluminum that formed the gleaming facade of the tower cling to the steel.

The condition of floor studs on the steel hints to Mr. Gilsanz that the floor at this spot in the upper reaches of the north tower collapsed not because of a faulty weld, but for some other reason that investigators have still not determined.

Another piece of steel recently discovered has a series of steel washers that are cracked, a worrisome sign to Mr. Sharp, whose company, TurnaSure L.L.C., designs super strong fasteners that have been installed in some of the world's tallest buildings. "I would not anticipate this happening, and I want to know what it did," he said, adding that a cracked washer significantly reduced the strength of a bolted connection.

Perhaps the deepest mystery uncovered in the investigation involves extremely thin bits of steel collected from the trade towers and from 7 World Trade Center, a 47-story high rise that also collapsed for unknown reasons. The steel apparently melted away, but no fire in any of the buildings was believed to be hot enough to melt steel outright.

A preliminary analysis of the steel at Worcester Polytechnic Institute using electron microscopes suggests that sulfur released during the fires -- no one knows from where -- may have combined with atoms in the steel to form compounds that melt at lower temperatures.

Out in the **scrapyard,** the engineers who volunteer their labor give various reasons for their presence. Some, like Mr. Sharp, knew people Who died in the attack. Others cite a sense of obligation to help out in the face of such a catastrophe. "The firemen certainly made the ultimate sacrifice," Ms. Bonilla says. "So did the police. As an engineer, you somehow feel like you have a duty to supply some answer."
http://www.nytimes.com

GRAPHIC: Photos: David F. Sharp, standing, and Anamaria Bonilla examine steel at the Hugo Neu Schnitzer East **scrapyard** in Jersey City. (Fred R. Conrad/The New York Times)(pg. B1); Steve Shinn, a site manager, with cranes that are moving debris, to be tested later, from the World Trade Center. (Fred R.

Conrad/The New York Times)(pg. B2)

Chart: "Clues in Steel"
A cross-section of a damaged steel beam from the World Trade Center reveals that it may have been weakened by contaminants in the fire.

Compounds apparently formed among atoms in the steel and sulfur from an unknown source. The compounds, called eutectics, have a lower melting point than ordinary steel and could have caused structural members to erode quickly in the fires.
(Source: Journal of Metals)(pg. B2)

LOAD-DATE: February 2, 2002

Copyright 2002 The New York Times Company
The New York Times

March 2, 2002, Saturday, Late Edition - Final

SECTION: Section A; Page 1; Column 3; Metropolitan Desk

LENGTH: 1586 words

HEADLINE: A NATION CHALLENGED: GROUND ZERO;
Burning Diesel Is Cited in Fall Of 3rd Tower

BYLINE: By JAMES GLANZ and ERIC LIPTON

BODY:
Massive structural beams that functioned as a sort of bridge to hold up the 47-story skyscraper known as 7 **World Trade Center** were compromised in a disastrous blaze fed by diesel fuel, leading to the building's collapse on Sept. 11, investigators have concluded in a preliminary report.

The tower was set on fire by debris from the twin towers and burned for about seven hours before collapsing in the late afternoon under previously unexplained circumstances. The analysis of its collapse is one of the first detailed findings by a team of engineers organized by the Federal Emergency Management Agency and the American Society of Civil Engineers to understand the fate of all the buildings around the site. As much as 42,000 gallons of diesel fuel was stored near ground level in the tower and ran in pipes up to smaller tanks and emergency generators for Mayor Rudolph W. Giuliani's command center, the Secret Service's office and other tenants.

Investigators have determined that the burning fuel apparently undermined what is known as a transfer truss. The trusses, a series of steel beams that allowed the skyscraper to be built atop multistory electricity transformers, were critical to the structural integrity of the building and ran near the smaller diesel tanks.

A failure of the same type of structural bridge contributed to the collapse of the Alfred P. Murrah Federal Building in Oklahoma City when it was bombed in 1995. Federal guidelines for public buildings, created in 1996, warned of the dangers of such trusses in terrorist attacks.

"It's certainly right in the vicinity where the columns go into this transfer system," said a person knowledgeable about the investigators' draft report on the **World Trade Center.** "The rest of the building is built on top of the bridge."

While 7 **World Trade Center,** which stood across Vesey Street just to the north of the twin towers, was not formally a federal building, it did house crucial government offices that included the city's nerve center for emergency response.

The investigators said that their conclusions, combined with other findings about the failure and collapse of 5 **World Trade Center,** could prompt serious changes in the codes used in building construction.

The findings are in a draft report that has already been circulated among government agencies, and are based on videos made on Sept. 11, witnesses' reports, interviews with firefighters, evidence from the debris pile and structural analysis. Team members, who described many of the findings, cautioned that the conclusions on the collapse of 7 **World Trade Center** could still be modified as reviews proceed.

But Irwin Cantor, one of the building's original structural engineers, who is now a consulting engineer and member of the City Planning Commission, said the diesel-related failure of transfer trusses was a reasonable explanation for the collapse.

He said he believed that diesel tanks were not envisioned in the original design of the building. "It ended up with tenants who had diesels," Mr. Cantor said. "I know none of that was planned at the beginning."

According to floor plans submitted to the Port Authority of New York and New Jersey, which owns the land on which 7 World Trade sat, the building complied with city fire codes, said Frank Lombardi, the authority's chief engineer. Those codes permit no more than one fuel tank with a capacity of 275 gallons or less on above-ground floors, he said.

Jerome M. Hauer, who was the director of Mayor Giuliani's Office of Emergency Management at the time the command center was opened at 7 World Trade, said several teams of engineers reviewed plans to open the office there. But no one ever mentioned any hazard associated with placing fuel tanks above ground, near a transfer truss, he said.

"There were a host of people who looked at this," said Mr. Hauer, who is now a managing director of the crisis and consequence group at Kroll Worldwide, a security consulting company based in New York. "We relied on their judgment."

Fire officials did at one point question the storage of large amounts of fuel well above the ground level, saying that one large tank for the mayor's command center, if ever compromised, might fuel a fire that would threaten the building.

The Sept. 11 draft report also has photographs and a description of debris collected from a previously undisclosed, multistory collapse within 5 **World Trade Center,** a nine-story office building that also burned on Sept. 11 but largely remained standing. The team has found that one specific type of bolted connection, called a column tree connection, that joined floor-support beams, failed in the heat of the fires, causing the four-story collapse in the part of 5 World Trade at the corner of Vesey and Church Streets.

Although no one died as a result of the collapses in 5 and 7 **World Trade Centers,** since both stood long enough to be evacuated, the team's findings are likely to lead to recommended changes in the way public and government buildings are constructed, much the way similar studies did after the Northridge earthquake near Los Angeles in 1994 and the Oklahoma City bombing.

The team is still deliberating on how tightly it can pin down the precise train of events that led to the collapse of the twin towers themselves. But until now, the collapse of 7 World Trade has stood as one of the outstanding mysteries of the Sept. 11 attack, since before then, no modern, steel-reinforced high-rise in the United States had ever collapsed in a fire.

High-rise buildings are designed to be able to survive a fire, even if the fire has to burn itself out. The strategy is to ensure that the steel support structures are strong enough or protected well enough from fire that they do not give way in the time it takes for everything inside an office building, like furniture, to burn.

In major high-rise fires elsewhere in the country, such as the 1 Meridian Plaza fire in Philadelphia in 1991 and the First Interstate Bank fire in Los Angeles in 1988, this approach has worked. The 1 Meridian fire burned for 19 hours, leaping from floor to floor and burning out as combustible materials were used up. But the fires at 7 **World Trade Center** raged mainly on lower floors and never burned out, and in the chaos of Sept. 11, the Fire Department eventually decided to stop fighting the blazes.

"What the hell would burn so fiercely for seven hours that the Fire Department would be afraid to fight it?" said one member of the investigating team.

According to the Port Authority floor plans, 275-gallon diesel tanks sat on the fifth, seventh and eighth floors and were fed through pipes from the larger tanks near ground level. The team member said that while the diesel fuel remains the most likely candidate for feeding the fires, it was still unknown whether there could have been other sources of fuel in the building, kept there by tenants like the Secret Service that have disclosed little of what their spaces contained.

The huge steel transfer trusses ran mostly through the fifth, sixth and seventh floors where the fires burned. The purpose of the trusses, which included zigzagging and horizontal members and were concentrated around the building's core, was to allow 7 World Trade to be built over two Consolidated Edison substations that already existed on that spot when the building went up in the late 1980's. Together the stations held 10 transformers, each about 35 feet high and 40 feet wide.

Using the trusses to avoid having vertical structural columns pierce the transformers, the building was constructed around them like a hen sitting on a giant egg.

"We had to do design tricks to accommodate the existing Con Ed facility," said Mr. Cantor, the structural engineer. "This building had an awful lot of transfers."

Transfer trusses are a well-tested technique and are used in countless high-rise buildings, as well as in bridges around the world. Engineers say that transfer trusses, for most buildings, present no extraordinary hazard. But if there is an explosion, earthquake or long-burning fire, they can present a problem.

In Oklahoma City, during the 1995 bombing of the Federal Building, a large transfer girder on the building's third floor gave way, helping to precipitate a progressive collapse that later analysis showed was responsible for most of the 168 deaths. After this attack, federal guidelines for buildings that would hold government agencies were changed, recommending that buildings be designed so that single-point failures did not cause a catastrophic collapse.

Videos of the 5:28 p.m. collapse of 7 World Trade lend vivid support to the truss-failure theory. Roughly 30 seconds before the building goes down, a rooftop mechanical room starts to disappear, falling into the building's core. Then a second larger rooftop room sinks. The building then quickly collapses.

Both rooms were above sections of the building held up by the trusses. Other video evidence shows fire concentrated in the floors containing the trusses and the fuel tanks.

Dr. John D. Osteraas, director of civil engineering practice, Exponent Failure Analysis Associates, in Menlo Park, Calif., reviewed videos of the collapse, discussed it with other engineers and came to a similar conclusion; the fuel, the trusses and the fire brought 7 World Trade down. "The pieces have come together," he said. "Without the fuel, I think the building would have done fine."
http://www.nytimes.com

GRAPHIC: Drawings (Downtown model by Urban Data Solutions); (Farhana Hossain and Juan Velasco/The New York Times)(pg. A8)

Chart: "Analyzing A Collapse"

Investigators examining the collapse of 7 **World Trade Center** have evidence indicating that failure of critical structural supports known as transfer trusses caused the building's vertical support columns to give way.

THE COLLAPSE

1. Day of Sept. 11
Fire, possibly fed by generator diesel fuel, softens the steel of transfer trusses.

2. 5:28:30 p.m.
East mechanical house sinks into the building, suggesting that columns supported by the sagging trusses are falling.

3. 5:28:35 p.m.
West mechanical house sinks, indica-ting the failure of the entire core structure.

4. 5:28:37 p.m.
The entire 47-story building starts to fall.

Diagram of the 7 **World Trade Center.**
EXTERNAL COLUMNS
INTERNAL COLUMNS

TRANSFER TRUSSES
A series of bridge-like structures allowed the building to be built atop a transformer station.

LOCATION OF GENERATORS AND SMALL FUEL TANKS

TRANSFORMER STATION

EAST MECHANICAL HOUSE
WEST MECHANICAL HOUSE
(pg. A8)

LOAD-DATE: March 2, 2002

---

www.nytimes.com
The New York Times
ON THE WEB

March 4, 2002

Widows Seek Wider Inquiry Into Trade Center Collapse

By ERIC LIPTON

Several dozen widows and parents of World Trade Center victims, as well as New York City firefighters, intend to travel to Washington on Wednesday to urge Congress to expand the federal investigation into the structural failure of the twin towers.

The group plans to attend a hearing before the House Science Committee, where several fire and engineering experts will review the progress of the inquiry. The hearing is scheduled for Wednesday afternoon.

The two planes that struck the buildings on Sept. 11 cut through part of the steel core of the towers, and fire fed by the airplane fuel weakened their structural steel. But Sally Regenhard, who is organizing the Washington trip, said that assuming the collapse was inevitable was wrongheaded.

"We want to know why it happened and what can be done to prevent it from ever happening again," said Ms. Regenhard, whose son, Christian Regenhard, a probationary firefighter, died in the Sept. 11 attack.

The Federal Emergency Management Agency, in collaboration with the American Society of Civil Engineers, is trying to determine the exact sequence of events that led to the collapse of the towers. But Ms. Regenhard, as well as a number of engineers and fire safety experts, insist the investigation is insufficient. She intends to urge members of Congress to finance a much broader and more expensive inquiry to determine whether vulnerabilities exist in other skyscrapers.

Ms. Regenhard also wants the federal government to investigate evacuation and firefighting procedures, to potentially help reduce the loss of life in the event of another terrorist attack or a major skyscraper fire.

DealBook
A free daily e-mail digest delivered before the opening bell.

SIGN-UP NOW ›

Copyright 2002 The New York Times Company | Privacy Information

NYPOST.COM

D.C. RIVALRIES HOLDING UP PROBE OF TOWERS' COLLAPSE

By VINCENT MORRIS

March 4, 2002 -- WASHINGTON - Government secrecy and a lack of cooperation are hampering the investigation into why the World Trade Center towers collapsed, a congressional committee says.

The House Science Committee cited a lack of teamwork that allowed critical evidence, such as steel girders, to be shipped off to recycling plants without a look. It also complained that authorities haven't let investigators see building blueprints and diagrams.

"The investigation has been hampered by a number of issues," says the committee, which on Wednesday holds the first congressional hearing into the collapse.

Even after authorities made rubble from the collapse available for study, "many pieces of steel still managed to escape inspection," the committee concluded, in an investigative outline obtained by The Post.

The committee did not specify which government agencies it was criticizing.

The Federal Emergency Management Agency, which paid a private group of engineers $600,000 to study the question, is expected to release its initial findings in April.

Home

NEW YORK POST is a registered trademark of NYP Holdings, Inc.
NYPOST.COM, NYPOSTONLINE.COM, and NEWYORKPOST.COM
are trademarks of NYP Holdings, Inc.
Copyright 2001 NYP Holdings, Inc. All rights reserved.

The New York Times
WEDNESDAY, MARCH 6, 2002

Copyright © 2002 The New York Times

New Rules Proposed To Help High-Rises Withstand Attacks

**By ERIC LIPTON
and JAMES GLANZ**

The leader of the investigation into the World Trade Center's collapse and the director of the federal agency that evaluates major fires and building failures are calling for the adoption of new national standards for the construction of public and governmental buildings to make them more resistant to catastrophic failures in the event of terrorist attacks.

The call for the new standards — to be made publicly for the first time at a Congressional hearing today in Washington — could have serious implications for how skyscrapers are designed and built, and, of course, for how much it costs to build them. Some experts say that the recommendations could effectively result in limiting the height of high-rises in the United States, and could discourage the use of very commonplace designs, like open, arching atriums below towering office structures.

It is impossible to assess immediately the full consequences of the recommendations made by the experts, two of the most respected engineering minds in the nation. There is no federal agency that has the power to enforce building codes in every locale across the country.

But federal recommendations af-

Continued on Page A23

Seeking New Rules to Help Towers Stand Up to Terror

Continued From Page A1

ter disasters have traditionally resulted in substantial changes in codes enacted by state and local governments from New York to California. For example, after the San Fernando earthquake in 1971, many western states adopted a uniform building code to make buildings more resistant to quake damage.

Any changes in buildings codes and standards would have to be balanced against financial concerns and possible resistance from real estate interests, construction trades and corporations that pay for and occupy tall buildings. But what is clear is that the trade center disaster — far from being labeled an isolated catastrophe — is already being cited as a justification for considerable changes in building practices.

"It is imperative for the U.S. to learn from the worst-ever building disasters in human history, and take aggressive remedial action to minimize future losses," said Arden L. Bement Jr., director of the National Institute of Standards and Technology, the federal agency that examines building fires and collapses, in remarks prepared for his testimony today before the House Science Committee.

Dr. W. Gene Corley, senior vice president of Construction Technology Laboratories in Skokie, Ill., and the leader of the trade center investigative team, said in his remarks, "We must now live, build and function in a world where the performance demands placed on our built infrastructure have been altered."

At the heart of the recommendations is the effort to ensure that in the future, if prominent buildings were to lose a single critical structural support, or even several, in a blast, an airplane crash or other unexpected event, the structure would be able to redistribute its loads and not collapse entirely.

In practice, the demand for greater structural stability could mean anything from requiring more columns in certain types of buildings to demanding stronger connections between critical steel supports. But they could also have the effect of ruling out conceptual designs for some lightweight, soaring structures with open spaces underneath heavy loads, designs that have become increasingly commonplace, but that might well lack the kinds of secondary support safeguards now deemed essential.

Practicing architects and engineers, while not surprised to hear the call for more stable buildings, said that if heeded, the implications could be profound.

"If it's properly written, the upside is we get safer buildings and if there are extreme events in the future, that people are allowed to escape," Tod Rittenhouse, a structural engineer who is a principal at Weidlinger Associates in Manhattan, said of any new code. But he added, "It could have a severe impact on the designs of the future."

This call for design changes to prevent what the experts call progressive collapses — chain reactions of failures that multiply the direct effects of triggering events like a bomb, a plane crash or a major fire — is among the first recommendations to emerge from the six-month investigation of the trade center catastrophe by the team, organized by the Federal Emergency Management Agency and the American Society of Civil Engineers.

The investigators also recommend that building designers consider the dangerous interaction between structural damage and fire, rather than the current process in which a building's structural strength and its fire protection are considered as nearly separate problems to be solved.

That sort of interaction, the team believes, was instrumental not only in the collapse of the twin towers, but also of 7 World Trade Center, a 47-story office building at the northern edge of the site.

The recommendations come after months of poring over videotape, steel debris and trade center blueprints. Investigators have not arrived at an exact explanation of all the collapses, nor have they settled the vital question of whether any building could have withstood the attack and remained standing.

But they have already seen enough evidence to conclude that progressive collapse played a critical role in magnifying the damage at the trade center, as it did in the 1995 bombing of the Alfred P. Murrah Building in Oklahoma City. The evidence includes determinations of how certain columns failed, how bolted connections gave way, how fireproofing was overwhelmed by the blazes, and just how the buildings finally gave way.

A formal report on the investigation is expected this spring. But preparing initiatives for changes in building codes and engineering practices is something that could take many more months of research, and incorporating them into local codes nationwide could take years.

The idea that disasters, whether natural or intentional, can have an impact on building codes has a long history, as illustrated by the California earthquakes in San Fernando in 1971 and Northridge in 1994, as well as the Oklahoma City attack.

Recommendations could mean major changes in building practices.

Just five years after the San Fernando earthquake, western states had incorporated lessons learned from the catastrophe into basic building codes. Both California earthquakes also led to the adoption in 1997 of national guidelines to reduce earthquake hazards to buildings, proposals that were incorporated into a national building code in 2000. In a vote scheduled for today, the New York State Code Council is expected to adopt a modified version of those seismic recommendations.

Because of fears generated by the Sept. 11 attacks, building developers and owners are already asking for reviews to assess whether designs for new skyscrapers or existing high-rises make them vulnerable to progressive collapse, said Charles H. Thornton, chairman of LZA/Thornton-Tomasetti, a structural engineering firm in Manhattan.

Mr. Thornton said that sophisticated computer modeling could in many cases lead to engineering changes that guard against progressive collapse while adding only modestly to a building's cost. But he said more elaborate measures — guarding against powerful blasts, for example — could potentially double a building's cost, and might be met by opposition from developers and building owners who must foot the bill.

In the ashes of the trade center attacks, architects, engineers and construction experts across the board seem to agree that lessons from the disaster are likely to reverberate through the building community. Some structural engineers say it will be important to decide exactly how big a category of buildings any new codes would apply to: every structure over five stories, or just those that have prominence or symbolic power that might attract attacks.

"People will begin to make value judgments," said Norman Koonce, an architect who is the executive vice president and chief executive of the American Institute of Architects. "This is something that's extremely critical not just to the architects, but to the American public as well."

A REPORTER AT LARGE

THE TOWER BUILDER

Why did the World Trade Center buildings fall down when they did?

BY JOHN SEABROOK

Structural engineers make buildings stand up, but the public doesn't pay much attention to what they do until a building falls down. Although the safety of a building's occupants depends on its structure, most people notice only the aesthetics, the furnishings, and the view, and give the architects, not the engineers, all the credit (or blame) for the results. Very few inhabitants of modern high-rises know where the load-bearing columns are placed, and how they are supported, or whether the building is a frame structure or a tube structure, and almost no one checks above the ceiling tiles to see how the floor overhead is attached to the vertical supports—all decisions that are worked out by the building's structural engineers. The anonymity of the high-rise structural engineer is the reward for his genius. Part of the awe that skyscrapers command lies in their apparent freedom from gravity: they're not just tall; they're effortlessly tall.

Since the collapse of the World Trade Center towers, on September 11th, structural engineers and their profession have received a great deal of public attention. University engineering departments around the country have been staging public forums in which the "mechanics of failure" are debated; there's one at Columbia University this week. The American Society of Civil Engineers and FEMA (the Federal Emergency Management Agency) are funding a team of twenty-four civil and fire-safety engineers to investigate what parts of the Twin Towers' structure failed first, and how much damage was caused by the impact and blast of the airplanes, and how much by the ensuing fires. Dr. W. Gene Corley, a structural engineer with Construction Technology Laboratories, in Skokie, Illinois, who led FEMA's investigation into the collapse of the nine-story Murrah Building, in Oklahoma City in 1995, is the over-all director of FEMA's inquiry into the World Trade towers. In addition to inspecting the site of the disaster, he told me, his team will review photographs and enhanced videos of the collapse, examine the debris, and use information from firemen, policemen, survivors, and other witnesses in an attempt to reconstruct the moment at which each structure failed.

Of course, you don't need an engineer to tell you why the towers fell down: two Boeing 767s, travelling at hundreds of miles an hour, and carrying more than ten thousand gallons of jet fuel each (if you converted the energy in the Oklahoma City bomb into jet fuel, it would amount to only fifty-one gallons), crashed into the north and south buildings at 8:45 A.M. and 9:06 A.M., respectively, causing them to fall—the south tower at 9:59 A.M. and the north tower at ten-twenty-eight. Nor do we need a government panel to tell us that the best way to protect tall buildings is to keep airplanes out of them. Nevertheless, there is considerable debate among experts about precisely what order of events precipitated the collapse of each building, and whether the order was the same in both towers. Did the connections between the floors and the columns give way first or did the vertical supports that remained after the impact lose strength in the fire, and, if so, did the exterior columns or the core columns give way first? "That's the sixty-four-thousand-dollar question," said Ron Hamburger, a structural engineer with ABS Consulting, in Oakland, California, who is also on FEMA's team, when I asked which of these scenarios he favored. Although there may never be another event like the attack on the towers, the disaster also highlights several potential weaknesses in the way that many modern high-rises are constructed—weaknesses that the designers of the tall buildings of the future may want to consider.

Leslie E. Robertson is the engineer who, with his then partner, John Skilling, was mainly responsible for the structure of the Twin Towers. Unlike most of his colleagues, who have been widely quoted and interviewed, he has remained largely out of the public eye since September 11th. His only public appearance was at a previously scheduled meeting of the National Council of Structural Engineers Associations, on October 5th, in New Hampshire, where, as the *Wall Street Journal* reported, on being asked by an engineer in the audience, "Is there anything you wish you had done differently in the design of the building?," Robertson broke down and wept at the lectern. Guy Nordenson, a structural engineer in New York and a professor at Princeton, who, like many of his colleagues, regards Robertson with great respect, showed me a recent E-mail he had received from him. It was a response to a letter Nordenson had written to the *Times*, praising the towers' structural design for keeping them standing as long as they did, and allowing some twenty-five thousand people to escape. "It's very Les," he said, referring to Robertson, and pointed at his computer screen. "Almost Shakespearean." Robertson had written:

> Your words do much to abate the fire that writhes inside
> It is hard
> But that I had done a bit more . . .
> Had the towers stood up for just one minute longer . . .
> It is hard.

On a brilliantly sunny fall morning in late October, I visited Robertson's offices, on the top two floors of 30 Broad Street, a forty-eight-story building that stands a few blocks from Ground Zero. From the windows of the conference room where I waited for Robertson, there was a clear view down into the rubble where the south tower once stood. Fires were still burning inside the pit, and the smell, that sweet acrid odor of burning metal and decay, was noticeable in the room. Many of the firm's sixty employees, including Saw-Teen See, Robertson's

"I have a lot of tough nights." Leslie E. Robertson, who helped design the World Trade Center, said. Photograph by Alen MacWeeney.

wife, who is also a partner in the firm, stood by these windows and watched as the second plane flew in over Hudson River Park, banked, and disappeared inside the south tower. See remembers closing her eyes at that moment, and didn't see the fireball come out the other side.

I turned away from the view and studied pictures of other buildings that Robertson's firm had worked on over the years, which were displayed around the room, including the Bank of China Tower, in Hong Kong, a twelve-hundred-and-nine-foot structure engineered by Robertson for I. M. Pei. Pei's characteristic triangular shapes had been seamlessly translated into gigantic diagonal braces on the sides of the building. Structural engineers commonly complain that architects don't understand how to construct high-rise buildings, from either a structural or an economic perspective, leaving it to the engineers to wrestle with the problems posed by the architecture and to resolve them in a way that allows the potential contractor to submit a bid for the project that is within the developer's budget. Such a perfect marriage of architecture and structure as the Bank of China Tower is unusual in the creation of skyscrapers, but it is a distinguishing feature of many of the buildings that Robertson has worked on over the years, and especially the World Trade towers.

On entering the room, Robertson walked over and looked out the window at the smoking pile where his structures had once been. He seemed to do this casually, but as we stood there I noticed that he was trembling slightly. He remained before the window for almost a minute, with the air of a man forcing himself to confront something he didn't want to confront, nodding as though to say, O.K., this is reality, I know it—but

"They say we can go there for Thanksgiving or they can cut us out of the will. Our choice."

looking bewildered at the same time. When we sat down, he said, "The World Trade Center was a team effort, but the collapse of the World Trade Center is my responsibility, and that's the way I feel about it."

Robertson, who is seventy-three, wore a gray silk shirt that was open at the collar. His hair is mostly white, and longish, falling over his ears, and with bangs in front, which gives him a slightly bohemian look. His brown eyes are like very deep pools, and the flesh below the eyes was swollen, either with fatigue or with grief. As we talked, he frequently looked out the window. I felt the absence of the buildings in him. "That's how people introduced me," he said. "I was the designer of the World Trade Center. Although that was wrong, actually—I only assisted on the team that designed it. But that's who I was."

Robertson was in Hong Kong on September 11th, having dinner with the developers of a skyscraper that will be built in Kowloon. "A woman's cell phone rang, and she said an airplane had hit the World Trade towers. I thought it was an accident, one of the helicopters that were always flying overhead. A short time later, my wife called me and said the second plane had hit, and I went upstairs and turned on the television. I knew both buildings were hit by planes, both on fire. I had no idea whether there were a thousand people or fifty thousand people at risk. I knew the fire was burning out of control, I knew people were jumping to get away from the heat. . . ." His eyes searched the empty view again.

"Before the buildings collapsed," I asked, "did any part of your brain, calculating, say, 'There's probably this amount of jet fuel, this amount of fire protection—the building has this long to last'?"

"I can't . . . I think there are times when logic just isn't the right way to think." Robertson's eyes were filling with tears. "This all took place in an hour and a half. The TV was on. I don't know if what I saw was the buildings falling down on rerun or whether it was live. I was just focussed on getting back to New York City. I remember packing my bags. And when the building collapsed—it was totally devastating."

During the last hundred and twenty years, three major types of structures have been employed in tall buildings in New York City. The first type was used in the cast-iron buildings of the eighteen-eighties and nineties, in which the "gravity load"—the weight of the building—was carried mostly by the exterior walls. This type of structure creates factory and warehouse spaces (and, now, residential lofts) that are relatively free of internal supporting columns—more usable real estate for the tenants—but, when combined with wooden floor beams and more lenient building codes, it also makes the buildings vulnerable to collapse. In a fire, the floors tend to collapse, and the iron frame loses strength and implodes.

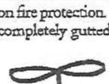
The second generation of tall buildings, which includes the Metropolitan Life Building (1909), the Woolworth Building (1913), and the Empire State Building (1931), are frame structures, in which a skeleton of welded- or riveted-steel columns and beams, often encased in concrete, runs through the entire building. This type of construction makes for an extremely strong structure, but not such attractive floor space. The interiors are full of heavy, load-bearing columns and walls, and, as you move toward the center of these buildings, the more crypt-like they feel. Charlie Thornton, of the Manhattan-based structural-engineering firm of Thornton-Tomasetti Engineers, a leading designer of the structures of modern high-rises, said to me recently, "A building like the Empire State Building is way overdesigned and overbuilt. The building didn't need all that support. Those engineers didn't understand loads the way we understand them—they used slide rules to work them out, whereas we have computers—and so they erred on the side of caution."

Most high-rises erected since the nineteen-sixties use a third type of structure—a synthesis of the best aspects of the two previous kinds of structure. The perimeter structures of these buildings resemble tubes. Inside, a massive hollow core made of steel and/or concrete contains many of the services: elevators, stairwells, and bathrooms. Because the core and perimeter columns carry so much of the load, the designers could eliminate interior columns, with the result that there is more open floor space for the tenants. And, because frame structures require ironworkers to weld or rivet the beams to the supporting columns on site, which is both expensive and dangerous, reducing the extent of the frame means that more of the structure can be fabricated off site, making the building safer and more cost-effective to erect. Finally, improvements in metallurgy increased the strength of the structural steel in these buildings, allowing engineers to reduce, or eliminate, the use of concrete in supporting the structure. Reinforced concrete, although it is more fire-resistant than steel, is messy and expensive to work with, especially in Manhattan, where traffic and space constraints at sites make it difficult to bring in the daily fleets of cement mixers necessary for a big job.

The floors in most of the high-rise buildings erected since the sixties are much lighter in weight than the floors in the older buildings. In a typical high-rise office floor, three or four inches of concrete covers a corrugated-steel deck, whose weight is supported by I-beams or, in the case of the Twin Towers, by long "trusses"—lightweight strips of steel that are braced by crosshatched webs of square or cylindrical bars, creating a hollow space below each floor surface. This space allows builders to install heating and cooling ducts within the floors, rather than in a drop ceiling below them—an innovation that means the developer can increase the number of floors in the entire building.

All of these improvements led to a high-rise building boom in New York City during the sixties and seventies; the World Trade towers, conceived in 1963 and opened in the early seventies, were the most famous products of that era. But, as the new high-rises sprouted, some New York City firefighters began to point out that the same innovations that make these buildings more economical to erect and more pleasant to inhabit also make them more vulnerable to fire. In 1976, the New York City Fire Commissioner, John O'Hagan, published a book entitled "High Rise/Fire and Life Safety," in which he called attention to the serious fire-safety issues in most high-rise buildings constructed since 1970, referring to such buildings as "semi-combustible." Unlike the earlier generation of skyscrapers, which used concrete and masonry to protect the structural steel, many of the newer buildings employed sheetrock and spray-on fire protection. The spray-on protection generally consisted of either a cementlike material that resembles plaster or a mineral-fibre spray, such as the one used to protect the floor joists in the World Trade Center. O'Hagan pointed out that, even when these spray-ons are properly mixed and applied to the steel (which must be clean), they are much less dense than concrete and can be easily knocked off. The swaying of the cables in the elevator shafts has been known to dislodge the fire protection from the columns in the cores of these buildings, and the coating used on floor supports is often removed by workers who install the ducts and wiring inside the hollow floor. The questionable performance of the fire protection used in these buildings, combined with the greater expanse of lightweight unsupported floors, O'Hagan said, created the potential for collapse, of the individual floors and of the entire structure. He also pointed out that the open spaces favored by modern developers allowed fires to spread faster than the compartmentalized spaces of the earlier buildings, and that the synthetic furnishings in modern buildings created more heat and smoke than materials made out of wood and natural fibres.

O'Hagan's book did nothing to stop semi-combustible buildings from going up—a fireman's predictable lament about safety was not what a city in love with its skyscrapers wanted to hear. It was not until September 11th that the architects and builders of tall buildings began to think seriously about whether the modern methods of constructing high-rises needed to be revised. One indication that older high-rise buildings may be more fire-resistant than the newer high-rise buildings is the performance of the twenty-three-story building at 90 West Street—a Cass Gilbert-designed building, finished in 1907 (Gilbert also designed the Woolworth Building), whose structure was protected by concrete and masonry—compared with the performance of 7 World Trade, an all-steel building, from the nineteen-eighties, that had spray-on fire protection. Both buildings were completely gutted by fires on September 11th, but 90 West Street is still standing, and may eventually be restored. 7 World Trade, which had a gas main beneath it, collapsed after burning for seven hours.



Leslie Robertson was born in California in 1928. A poor student, he dropped out of high school at the age of sixteen and spent two years in the Navy, where he became an electronics technician. There, he says, "I learned that I actually knew how to do things, and if I wanted to I could get them done." His father had been an inventor, "a brilliant guy, but he never stuck at anything." After leaving the military, Robertson attended the University of California at Berkeley, where he received a bachelor's degree in science. He began his career by designing electrical systems for factories, and from there he moved into structural engineering. He worked for several engineering firms around the country, including Raymond International, where he assisted in the engineering of offshore-drilling rigs, until he decided to go back to California. Driving from New York to San Francisco in late 1958, he ran out of money in Seattle and took the first job he could get—working at a firm of structural engineers then called Worthington-Skilling.

In 1963, the firm entered a competition held by the Port Authority of New York and New Jersey to build in New York City what would be the tallest buildings ever constructed—the two towers of the World Trade Center. It was one of eight engineering firms—most of them large partnerships in New York—asked to submit proposals. Although the firm's tallest building up to that point was the twenty-story I.B.M. Building in Seattle, the architect of that building was Minoru Yamasaki—the same architect the Port Authority had selected for the World Trade Center. At a meeting to present the firm's proposal to the architect and developers, John Skilling, one of the four partners, used only a drawing pad, an easel, and some markers to make his pitch.

The man the Port Authority had chosen as the architect of the tallest buildings in the world was afraid of heights. The glass curtain-wall skyscrapers, in which the only separation between you and the outside is a thinnish piece of glass, frightened Yamasaki. He thought tall buildings should have structural elements around the perimeter, so that the occupants would feel secure in them. In engineering the I.B.M. Building for Yamasaki, Skilling's firm had come up with a structure in which the exterior walls were made of closely spaced steel pipes. Yamasaki liked the soothing effect that the pipes had on his acrophobia, and the building's vertical aspect—it appears to be dressed in a pin-striped suit—appealed to his aesthetic. Yamasaki had something similar in mind for the World Trade Center, but on a much larger scale: solid elements at the edges, which he could brace himself on before looking out. "And Yama was not a large man," Saw-Teen See told me, "so the columns couldn't be too far apart."

What Skilling proposed was a pure tube structure. His design was consistent with the general principles at work in the new generation of high-rises, but he carried the concept of the tube building farther than it had ever been taken before. (Or since: the Sears Tower, in Chicago, which replaced the World Trade towers as the world's tallest building in 1973, is also a tube building, but it is actually a cluster of nine smaller tubes.) The Twin Towers would be perforated steel boxes surrounding a hollow steel core. The outer box would be two hundred and eight feet on each side, and made of fourteen-inch-wide steel columns that were spaced on forty-inch centers—much closer than the fifteen-to-thirty-foot spaces that separate most supporting columns in a building. Like the cast-iron buildings of the previous century, the exterior walls would be load-bearing; unlike most skyscrapers, which hide their supporting columns, the Twin Towers would proudly wear their structure on their sleeves. Because there were so many load-bearing columns around the perimeter of each building, the engineers could completely eliminate all columns within the office space. Joining the outside tube to the inner core were state-of-the-art lightweight floor trusses that spanned sixty feet from core to exterior walls on two sides, and thirty-five feet on the other two sides. Yamasaki liked the design because it reminded him of a bamboo tube, an important totem for him. The Port Authority liked the design because, among other things, the towers would offer the single largest expanse of column-free office space in Manhattan—a realtor's dream.

Skilling's firm got the commission, and Robertson, then thirty-five, moved to New York to open a new office, and to supervise the structural aspects of the building's construction. In 1983, the Seattle office and the New York office split, becoming two separate firms. Skilling (who died in 1998) and Robertson later argued about who was more responsible for the structure of the towers. "These are guys with big egos, and things got a little testy between them regarding who was ultimately responsible for the design," says Jon Magnusson, the chairman and C.E.O. of the Seattle-based firm which is now called Skilling Ward Magnusson Barkshire. "Skilling said, 'It was me,' Robertson said, 'It was me,' but I think the truth is that both of them made a significant contribution."

The trick to designing tall buildings in windy places (like New York City and Chicago) is to endow them with enough elasticity to move with the wind but enough stiffness so that the people working on the upper floors don't know the building is moving. The World Trade towers used the perimeter walls, rather than the core, to brace the buildings against the wind, a concept that recalled the first generation of high-rises. As Robertson described the models and experiments he had devised to test how the towers would stand up to external forces that might topple them, he looked almost happy for the first time that morning. He built models of the towers and placed them in a wind tunnel; he put people in motion simulators and observed their behavior; he invented a new kind of damper system to lessen the effect of the wind throughout the buildings. He rode on top of elevator cars in other skyscrapers to see whether the cables banged against the cores of the buildings.

He also designed the buildings so they would be able to absorb the impact of a jet airliner: "I'm sort of a methodical person, so I listed all the bad things that could happen to a building and tried to design for them. I thought of the B-25 bomber, lost in the fog, that hit the Empire State Building in 1945. The 707 was the state-of-the-art airplane then, and the Port Authority was quite amenable to considering the effect of an airplane as a design criterion. We studied it, and designed for the impact of such an aircraft. The next step would have been to think about the fuel load, and I've been searching my brain, but I don't know what happened there, whether in all our testing we thought about it. Now we know what happens—it explodes. I don't know if we considered the fire damage that would cause. Anyway, the architect, not the engineer, is the one who specifies the fire system."

On September 11th, each building took the impact of a 767 (which is nearly twenty per cent heavier than a 707) and stood long enough to allow most of the people below the crash sites—the ninety-fourth floor to the ninety-ninth floor in the north tower, and the seventy-eighth floor to the eighty-fourth floor in the south tower—to escape. Had the buildings toppled immediately, nearly all those survivors would have died, and there would have been huge losses, as well in the buildings and streets around the towers. The fact that the terrorists chose to hit the buildings on opposite faces suggests to some that they intended to knock the buildings over—which would have increased the destruction and loss of life. "Ninety-nine per cent of all buildings would collapse immediately when hit by a 767," Jon Magnusson said.

But did the special structural characteristics of these buildings, qualities that made them so resistant to attack from without, also make them vulnerable to collapse from within, once the fires started? If one of the airplanes had hit an older skyscraper, like the Empire State Building, which has a frame structure instead of a tube structure, would the total disaster have been greater (the building falls over immediately) or lesser (the concrete in the building lasts longer in a fire, and the frame structure protects the building from complete collapse)? Of all the difficult questions that the FEMA investigators need to ask about the disaster, this is one of the hardest.

In any fire, it is logical to assume that the weakest link in the structure will be the first to fail. In the towers, the weak link was the floors. "Floor beams or trusses will heat up faster than columns, because they're thinner pieces of steel," W. Gene Corley, the leader of the FEMA team, says. The floors were supported with sixty-foot-long right angles of steel (on the long sides), and these were bolted, not welded, to the inner and outer columns. "The whole floor system was a very lightweight construction," Eduardo Kausel, a structural engineer at M.I.T., told me. Another engineer described the floors to me as "flimsy." Jerome Connor, also of M.I.T., said, "The weakest link was definitely the connections of the floor trusses to the vertical members." Those connections were protected with the mineral-fibre spray, but most of it was probably knocked off by the impact of the airplanes. Ron Hamburger told me, "If you knock it, that spray-on protection will come off. When I visited the site, I went through the American Express and the Bankers Trust buildings, and I saw large chunks of the fireproofing in those buildings knocked off—and that was only by falling debris, not by an airplane hit. I think we can assume there was a lot of unprotected steel in the towers after the planes hit."

The columns in the core were massive, and were capable of bearing huge gravity loads, but they depended on the floors to provide lateral support. As the floors around the crash site began to give way in the intense fire, ever greater lengths of the core columns, which were already overloaded because of the destruction of exterior columns, became exposed. If you stand an inch-long drinking straw on end and press on it with your finger, you have to press pretty hard before it bends. But if you do the same thing with a seven-inch-long straw it buckles easily. The same principle was at work in the towers' core columns. Once the core columns buckled, the entire weight of the floors above the crash sites came down like a jackhammer on the remaining floors, starting a chain reaction of pancaking floors and buckling columns which demolished the entire structure within fifteen seconds—the same amount of time it took the people who jumped from the top of the towers to hit the pavement. "Once the collapse started, it was essentially a free fall," Eduardo Kausel said. Kausel, for one, thinks the terrorists knew exactly how to make the towers fall—not by knocking them over but by triggering a collapse from within. "You'd need a graduate degree in engineering to know exactly where to hit those buildings to make them fall. Hit them higher, and the weight above the crash sites might not be enough to bring the whole thing down. Hit them lower, and the core columns might have been strong enough to stand up."

"Is it a boy or a girl?"

Of course, it also could have been the case that the core columns were damaged by the airplanes, or weakened by the fires, and that it was the failure in the structural members themselves, rather than the lack of support caused by the collapsing floors, that led to the over-all failure of the structure. The distinction here seems minor when set against the magnitude of the disaster, but it is important when you start thinking about how modern high-rise buildings are designed, and how safe they are. Although the Twin Towers were, in the words of Jon Magnusson, "of all the buildings in the world, the closest to being pure tube buildings," many other high-rises are based on the tube concept, and others have internal cores that are braced by the floors. How many floors would you have to remove in a tube-style building before it collapsed?

Robertson says he has thought a lot about the one-inch-thick cylindrical-steel webbing that was used in the support of the floors. He thought that the round steel rods might not hold spray-on fire protection as well as angled bars, but the contractor, Tishman Construction, could save money by using the cylindrical rods—they were a factory-produced item, and cheaper—and he approved them in the end. "On the other hand, there were other fires in the buildings over the years, and one quite serious one, and the fireproofing on those rods did O.K." As the developer, the Port Authority had the ultimate say in making decisions about building materials, and although all developers are driven by economic considerations, the Port Authority was exceptionally profit-minded. "Remember, this wasn't a corporate headquarters—a monument building," Robertson said. "It was a moneymaking proposition."

Was there any way for the structural engineers and architects involved in building the towers to know that they were going to collapse, and how quickly? Yamasaki died, of cancer, in 1986. Robertson was in Hong Kong. A group of engineers from his office were on their way to the site after the first plane hit, but when the second plane hit they went back to the office or left the area. Most of the Port Authority engineers, including the chief engineer, Frank Lombardi, worked in the north tower, and they were in the stairwell when the second plane hit, unaware of what had happened. Only when they had regrouped in the Marriott Hotel, on the southwest side of the plaza, did they learn about the second plane, and not long after that the upper part of the south tower fell onto the hotel, partially collapsing it. "I thought a bomb had come through the windows," Lombardi told me. "We had no idea of the extent of the damage, and certainly none of us had the information to make a decision to keep the rescue workers who entered the buildings out of them." He added, "I do think it may be a good idea, in the event of something like this happening in the future, to have a structural engineer on the scene, who arrives with the firemen, and makes that cold, objective decision to send people in or not send them. But, first of all, that person would have to have no emotional relationship to the people inside or to the building—I mean, for us, this was our second home—and, secondly, that person would have to be absolutely liability-free. Because that's one hell of a decision to make."

Among the dozens of people I have spoken to recently who are experts in the construction of tall buildings (and many of whom witnessed the events of September 11th as they unfolded), only one said that he knew immediately, upon learning, from TV, of the planes' hitting the buildings, that the towers were going to fall. This was Mark Loizeaux, the president of Controlled Demolition Incorporated, a Maryland-based family business that specializes in reducing tall buildings to manageable pieces of rubble. "Within a nanosecond," he told me. "I said, 'It's coming down. And the second tower will fall first, because it was hit lower down.'"

Before September 11th, the largest building ever to be imploded by accident or design was the J. L. Hudson department store, in Detroit, with 2.2 million square feet of floor space, which C.D.I. "dropped" on October 24, 1998. To do their work, Mark Loizeaux and his brother Doug need to understand the same forces and formulas that structural engineers study, but instead of using that knowledge to erect buildings they use it to take them down. They are structural undertakers, which may explain why Mark, when confronted with the spectacle of the crippled buildings, lacked the sentiment that builders feel for their creations—that innate sympathy which helped blind the engineers of the World Trade towers to the reality of what was about to occur. "I thought, Somebody's got to tell the Fire Department to get out of there," Loizeaux told me. "I picked up the phone, dialled 411, got the number, and tried it—busy. So I called the Mayor's Office of Emergency Management"—which was in 7 World Trade. "All circuits were busy. I couldn't get through."

Loizeaux said he had an enhanced video of the collapses, and he talked about them in a way that indicated he had watched the video more than once. "First of all, you've got the obvious damage to the exterior frame from the airplane—if you count the number of external columns missing from the sides the planes hit, there are about two-thirds of the total. And the buildings are still standing, which is amazing—even with all those columns missing, the gravity loads have found alternate pathways. O.K., but you've got fires—jet-fuel fires, which the building is not designed for, and you've also got lots of paper in there. Now, paper cooks. A paper fire is like a coal-mine fire: it keeps burning as long as oxygen gets to it. And you're high in the building, up in the wind, plenty of oxygen. So you've got a hot fire. And you've got these floor trusses, made of fairly thin metal, and fire protection has been knocked off most of them by the impact. And you have all this open space—clear span from perimeter to core—with no columns or partition walls, so the airplane is going to skid right through that space to the core, which doesn't have any reinforced concrete in it, just sheetrock covering steel, and the fire is going to spread everywhere immediately, and no fire-protection systems are working—the sprinkler heads shorn off by the airplanes, the water pipes in the core are likely cut. So what's going to happen? Floor A is going to fall onto floor B, which falls onto floor C; the unsupported columns will buckle; and the weight of everything above the crash site falls onto what remains below—bringing loads of two thousand pounds per square foot, plus the force of the impact, onto floors designed to bear one hundred pounds per square foot. It has to fall."

Loizeaux said that when he demolishes buildings he sometimes tries to make the top twist and fall sideways, which can generate enough "reverse thrust" to push the rest of the building the other way. "The top part of the south tower almost did fall off, which is what would happen in most buildings. Did you see how, when that top part started to fall, it began to rotate? If that piece had kept going out, it probably would have pushed the rest of the building the other way as it fell. But those long trusses saved the day—they gave way, guided that top downward just like a bullet through the barrel of a gun, and mitigated the damage." He added, "Let me tell you something. Far more people would have died if those buildings had been built differently. A conventional frame building would have fallen immediately—no question. Only a tube structure could have taken that hit and survived."

It is important to bear in mind, when discussing the towers' collapse, that most of the office workers who perished in the attack were trapped above the floors hit by the airplanes. Even if the buildings had stood for hours longer, the majority of them probably couldn't have been saved. Many of the people below the crash site who died in the collapses were the rescue workers, including three hundred and forty-three firemen, who entered the towers after the planes hit.

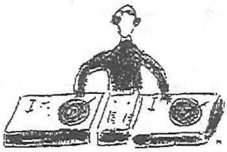
The firemen did what firemen do—they charged into the burning buildings and tried to save lives and put out the fire. There was little or no time to consider the potential for total collapse that was present in the tube structures. The chiefs and commanders were operating on standard F.D.N.Y. procedure on how to fight a high-rise fire: stay below the burning floors, and attack from there. The city's Department of

Buildings enforces the standards for how long the materials used in city buildings should stand up in fires. These standards are based on tests of individual building materials, conducted at testing centers around the country. Each material is subjected to rapidly rising temperatures, to discover the point at which it fails. During construction, the appropriate amount of fire protection is applied to that material to bring its longevity in a fire up to the required amount of time. (Because the towers were owned by the Port Authority, a bi-state agency, they were not subject to New York City fire regulations or inspections, but, according to Alan Reiss, the former director of the World Trade Center, the Port Authority always had a policy of complying with New York City fire codes and inspection procedures.)

Unfortunately, the standard fire scenarios didn't match the conditions in the World Trade towers, in several important ways. In the first place, the scenarios measure only the "fire load," or amount of combustible material, already in the building; the tests don't anticipate additional sources of energy that might be introduced into the building. Second, in calculating how long certain materials will last in a fire most tests don't anticipate the sudden intensity of fires such as those in the World Trade Center; usually, a fire starts small and spreads, so that the curve of temperature over time is a gradual rise to the peak. Nor do the tests anticipate the added stress on structural elements caused by impact, such as that of an airplane—steel fails at lower temperatures when under extreme stress.

New York City firemen are very familiar with the crash of the B-25 into the seventy-eighth and seventy-ninth floors of the Empire State Building, in 1945, which killed fourteen people; the department makes that event part of the standard training that every chief and commander receives. It is often true that those who don't remember history are doomed to repeat it, but it is also sometimes true that those who remember history can be misled by it. In the Empire State Building crash, the ensuing fire was a flash fire, fuelled not by jet fuel but by gasoline (which has a slightly lower heat content); in addition, the B-25 carried only eight hundred gallons of fuel—much less than the ten thousand or more gallons that spilled into each of the towers. As a result, the fire was put out in thirty-five minutes and did limited damage to the building. The fires in the towers were far hotter—they may have burned at close to two thousand degrees—and, because of the way the Empire State Building was "overbuilt," it was, in general, better able to resist fire.

Retired Deputy Chief Vincent Dunn, a forty-two-year veteran of the New York City Fire Department, who is the author of the book "Collapse of Burning Buildings: A Guide to Fireground Safety," told me, "The technology of building high-rises has got way ahead of the ability to fire-protect them adequately." He added, "No one wants to be alarmist, but we in the fire service know that in any high-rise building built since 1970 the fire safety is questionable." Dunn speaks only for himself, but his opinion of the structure of the Twin Towers is shared by others who are closely affiliated with the New York City Fire Department. "Look, from a fire chief's perspective—and I'm not an engineer, but as a fire chief I know buildings—the World Trade Center buildings were not well constructed," Dunn said. "I'd call them fragile buildings. There were no internal columns supporting the floors, and those floor trusses were very lightweight. Essentially, it was a pinned construction, where the exterior walls are the bearing walls. That's the way the old cast-iron buildings in SoHo were built, and, as every firefighter knows, in those buildings the floors collapse in fires. In my opinion, a skeleton steel building would have stood up better. Yes, you get sections falling off the building, maybe even the top part of the building falls off. But you don't get pancaking floors that bring the whole structure down." David Lucht, the director of the Center for Firesafety Studies at Worcester Polytechnic Institute, disagrees with Dunn's assessment of the safety of modern high-rises. "I can understand where the Fire Department is coming from—they don't build 'em like they used to," he said. "And that's true. But in many ways people are safer in high-rise buildings than they are at home." He pointed out that the newer buildings have the benefit of modern sprinkler and alarm systems, along with pressurized stairwells and floors that help keep smoke away from the fire areas. "High-rise buildings have performed amazingly well over the years in fires, although this event will cause both researchers and public officials to take another look at the performance of these buildings."



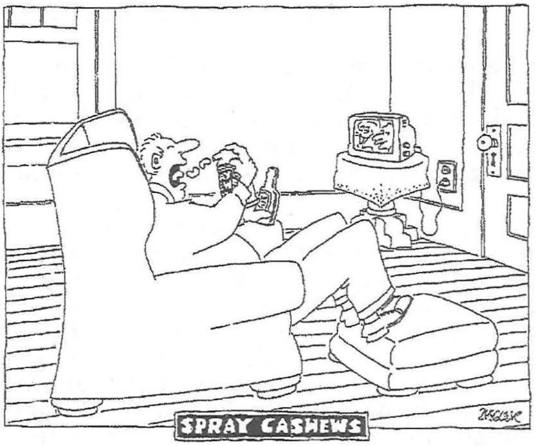
Dunn said that, had he been at the scene, he would have sent his men into the building. "I don't care how strong they were—if you've got buildings collapsing on firefighters, there's something wrong with the way those buildings were built."

Leslie E. Robertson Associates is assisting the various teams that are investigating the towers' collapse, and Saw-Teen See is on the FEMA team. Robertson told me he was glad that the efforts were going on, but he doubted whether we would ever understand the mechanics of failure precisely. "If we could learn why the buildings collapsed, there would be value in that," he said. "But that other event, in Oklahoma City—that was more quantifiable. This is a huge task—it's probably an impossible task now to sort out all the proper evidence."

Because each steel column used in the exterior of the towers had a mark stamped on it, in theory it would be possible to reassemble the pieces from the damaged floors. But the time and manpower that such an effort would require are beyond FEMA's resources. Besides, the core columns, not the external columns, would yield the most information about the collapses, but the videos and still pictures of the injured buildings don't show the condition of the core columns, and those columns were marked only with paint, which in most cases has disappeared. Robertson said that he and his wife went out to one of the scrap yards in New Jersey where some of the steel is being held, to inspect a piece that one investigator thought had an airplane part attached to it. "But we figured out that that piece of steel was from the fortieth floor, well below either crash site," he said.

Behind Robertson were renderings of what will be two of the tallest buildings in the world, both from the architecture firm of Kohn Pedersen Fox—the Shanghai World Financial Center and an office building in Hong Kong. Robertson is assisting in the design of the structures for both buildings. He said he had met with the developers of the skyscrapers after September 11th and reassured them that the structures of both buildings were sound. "I said that it was not necessary to design buildings with the idea of planes running into them. It's prudent to see what we could do, to make things better, but you can't design for every eventuality." He added, "I suspect tall buildings will always be with us. People need to be close to each other, in order to communicate effectively. But builders and architects are going to have to make the argument for why tall buildings should be built, and why people should move into them."

Charlie Thornton, of Thornton-Tomasetti, told me, "One of the things you'll hear is 'Should we use more concrete?' " Thornton's firm did the structural engineering for the Petronas Towers, in Kuala Lumpur, currently the tallest buildings in the world; those buildings have a concrete core and concrete perimeter columns, but that decision was based in part on the fact that Malaysia had no steel industry, and imposes high tariffs on imported steel. "Should we at least require the cores of tall buildings to be reinforced in concrete, which would give them more fire protection and give people a better chance of getting out in a fire?" he went on. "Should we have refuge floors, spaced every ten floors or so, which would allow people some protection from smoke?" But Robertson says, "Thank God we didn't have refuge floors in the World Trade towers—people might have stopped there to regroup, rather than getting out of the buildings as fast as they could."



Every high-rise building represents a balance of power; incorporated into the final design are the various interests of developers, architects, engineers, and firemen. Will September 11th change this hierarchy? The public interest, which is safety, is protected by building codes and laws, but the way those codes are written is not a democratic process. Professional engineers, together with academics and the representatives of construction companies, articulate the "minimum" standard of safety as determined by each constituency. Guy Nordenson, who has expertise in seismic codes, says, "We have a predicament not only for engineering but for planning and design in general. Developers and many designers participate in the economy of wealth, image, and fame, and so they press against that minimum." Nordenson and his associates at Princeton were completing a seismic study for FEMA of the buildings in New York when, after September 11th, they were called, along with the Structural Engineers Association of New York and Charlie Thornton's firm, to help the city check the stability of the buildings around Ground Zero. His opinion is that the collapse of the World Trade towers will change building codes. "The building laws will change—more redundancy, stronger interconnection of parts, all attributes of good seismic design, by the way—as they have after every disaster."

Still, it doesn't make sense to design skyscrapers to withstand the crash of an airliner—the buildings would resemble nuclear silos, and, as the chairman of the Nuclear Regulatory Commission suggested recently, even those structures might not withstand a fully fuelled airplane. Engineers can't be asked to make every building safe from every possible event, yet that is just what people expect, and the engineers try to meet these impossible expectations. Sitting in Robertson's conference room, I said that his structures had saved a lot of people. He said, "A lot of things worked well—people got out. I suppose I'm proud of that." But he was looking toward that unavoidable view from the window. "It's a tremendous responsibility, being an engineer," he said, his voice breaking. It's a very imperfect process. It's not so beautiful as science." He struggled to keep his composure. "I have a lot of tough nights. I'm still not sleeping. I go to sleep for a little bit, but I wake up thinking—I have so many thoughts."

He put his hands over his eyes, as though that would block out the thoughts. After a minute or so, he went on, "There are all kinds of terrible things that take place on this planet, that nature brings on us. But this event had . . . Not only was it man against man but it was live on television, and we watched it, and you could reach out and touch it"—he stretched out his hand toward the windows where the towers had once stood—"but there was nothing you could do." ◆

Learning from 9/11—Understanding the Collapse of the World Trade Center

Chairman BOEHLERT. The Committee will come to order. Before proceeding, I ask unanimous consent that Mr. Crowley and Mr. Engel be permitted to sit with the Committee. Without objection, so ordered. I want to welcome everyone to this hearing on a most important, but difficult, subject—the investigation into the collapse of the World Trade Center.

It is, indeed, a difficult subject because it is, at once, emotionally rending and intellectually complex. And it is also difficult because it forces us to cast a critical eye on the dedicated work of public servants and public-spirited volunteers who are taking action amid chaos brought on by an unforeseen and unprecedented tragedy.

But despite these difficulties and the discomfort they may engender, we felt we needed to put together this hearing. First, we believe that we owe it to the victims and their families to learn everything possible about what happened in those horrifying first hours of September 11—not just to satisfy their immediate needs and yearnings, but to ensure that such a catastrophic building failure and the resulting loss of life never happen again.

I must say that the current investigation—some would argue that review is the more appropriate word—seems to be shrouded in excessive secrecy. This has unnecessarily increased the families' anxiety while actually complicating matters. I hope this hearing, by airing the facts of the investigation, will dispel unnecessary concerns while allowing legitimate ones to be pursued more productively.

But, perhaps, even more important for the Committee, we need to have this hearing because the Trade Center collapse raises questions about Federal responsibilities and Federal policies—responsibilities and policies that have broader application than this one terrifying, and we pray, unique incident.

The Federal Government, as a matter of course, takes on investigations of catastrophic building failures whatever their cause. That is the only way we, as a Nation, can learn from building failures and change our building and fire codes to prevent future ones. Indeed, the engineering of buildings to withstand earthquake damage has improved markedly as a result of federally supported efforts.

Yet, in this case, the investigation has faced numerous obstacles. Federal agencies did not coordinate sufficiently. Some were slow to react. No organized team was at the site for weeks. Potentially valuable evidence has been irretrievably lost and blueprints were unavailable for months. What this experience clearly points up is that the Federal Government needs to put in place standard investigative protocols and procedures right now so we don't have to reinvent the wheel each time we face a building failure. That is one change in Federal policy that ought to result from the World Trade Center experience.

Another significant lesson of the Trade Center collapse is that we need to understand a lot more about the behavior of skyscrapers and about fire if we are going to prevent future tragedies. All of our witnesses today will call for an expanded Federal research effort into the details of what happened at the World Trade Center and what that means for buildings generally. I wholeheartedly endorse that call. My colleagues and I will have many questions today about the nature and scope and financing of that follow-up effort. But I, for one, think we need to move forward with it.

We will also do some following up of our own. I expect that the Committee will have a hearing on the report of the current Trade Center—will have a hearing on the report of the current Trade Center report when it is released in April, and we will obviously continue to oversee the related activities of the agencies in our jurisdiction and we will pursue any Federal issues that merit further review.

So all of us here, I believe, understand that we are undertaking a heavy responsibility today by reviewing the response to the World Trade Center collapse. September 11 is still a fresh wound. But this hearing is not so much about the past as it is about ensuring that we protect lives in the future. We are not here to point fingers, but to ensure that any problems that occurred in the wake of the Trade Center collapse do not hamper future investigations. We are here because the only way to move forward is to try to understand what happened on a day that was so incomprehensible. With that, I yield to Mr. Weiner.

[The prepared statement of Mr. Boehlert follows:]

PREPARED STATEMENT OF CHAIRMAN SHERWOOD L. BOEHLERT

I want to welcome everyone to this hearing on a most important, but difficult subject—the investigation into the collapse of the World Trade Center.

It is indeed a difficult subject because it is, at once, emotionally rending and intellectually complex. And it's also difficult because it forces us to cast a critical eye on the dedicated work of public servants and public-spirited volunteers who were taking action amid chaos brought on by an unforeseen and unprecedented tragedy.

But despite these difficulties and the discomfort they may engender, we felt we needed to put together this hearing. The Committee decided to move forward for two fundamental reasons. First, we believe that we owe it to the victims and their families to learn everything possible about what happened in those horrifying first hours of September 11th—not just to satisfy their immediate needs and yearnings, but to ensure that such a catastrophic building failure, and the resulting loss of life, never happen again.

I must say that the current investigation—some would argue that "review" is the more appropriate word—seems to be shrouded in excessive secrecy. This has unnecessarily increased the families' anxiety while actually complicating matters. I hope this hearing, by airing the facts of the investigation, will dispel unnecessary concerns while allowing legitimate ones to be pursued more productively.

But perhaps even more important for the Committee, we need to have this hearing because the Trade Center collapse raises questions about federal responsibilities and federal policies—responsibilities and policies that have broader application than this one terrifying—and, we pray, unique—incident.

The Federal Government, as a matter of course, takes on investigations of catastrophic building failures, whatever their cause. That's the only way we, as a nation, can learn from building failures and change our building and fire codes to prevent future ones. Indeed, the engineering of buildings to withstand earthquake damage has improved markedly as a result of federally supported efforts.

Yet in this case, the investigation has faced numerous obstacles. Federal agencies did not coordinate sufficiently, some were slow to react; no organized team was at the site for weeks; potentially valuable evidence has been lost irretrievably, and blueprints were unavailable for months. What this experience clearly points up is that the Federal Government needs to put in place standard investigative protocols and procedures right now, so we don't have to "reinvent the wheel" each time we face a building failure. That's one change in federal policy that ought to result from the World Trade Center experience.

Another significant lesson of the Trade Center collapse is that we need to understand a lot more about the behavior of skyscrapers and about fire, if we are going to prevent future tragedies. All of our witnesses today will call for an expanded federal research effort into the details of what happened at the World Trade Center and what that means for buildings generally. I wholeheartedly endorse that call. My colleagues and I will have many questions today about the nature, scope and financing of that follow-up effort, but I, for one, think we need to move forward with it.

We'll also do some of our own following up. I expect that the Committee will have a hearing on the report of the current Trade Center report when it is released in April, and we'll obviously continue to oversee the related activities of the agencies in our jurisdiction, and we'll pursue any federal issues that merit further review.

So, all of us here, I believe, understand that we are undertaking a heavy responsibility today by reviewing the response to the World Trade Center collapse. September 11th is still a fresh wound. But this hearing is not so much about the past, as it is about ensuring that we protect lives in the future. We are not here to point fingers, but to ensure that any problems that occurred in the wake of the Trade Center collapse do not hamper future investigations. We are here because the only way to move forward is to try to understand what happened on a day that was so incomprehensible.

Mr. WEINER. Thank you, Mr. Chairman. And, first, let me begin by expressing my thanks to you. While some of our committees have been slow to take up the challenge of the post-September 11 analysis and legislative action, you have been a true leader in getting the Science Committee involved.

On November 12, I, and my constituents, had the misfortune—and hundreds of families were ravaged by the crash of Flight 586. Within literally moments of that plane crash, the National Transportation Safety Board was on the ground sequestering evidence, interviewing witnesses, subpoenaing information, if necessary. And since then, they have offered periodic reports.

One month and a day earlier, when the World Trade Center collapsed, nothing could have been further from the truth. According to reports that we have heard since, there has been no comprehensive investigation. One expert in fire engineering concluded that there was virtually a nonexistent investigation. We haven't examined any aspects of the collapse that might have impacted rescue worker procedures even in this last month.

Second, reports have emerged that crucial evidence has been mishandled. Over 80 percent of the steel from the World Trade Center site has already been sold for recycling, much of it, if not all of it, before investigators and scientists could analyze the information.

Third, we have allowed this investigation to become woefully bogged down and in fighting and lack of cooperation among agencies. Researchers from FEMA did not get timely access to the designs of the building. News accounts have said there has been friction between engineers in FEMA because of concerns about where the information would wind up.

Even the National Science Foundation, which has awarded grants to several scientists to study the collapse, but didn't coordinate these efforts with FEMA or the American Society of Civil Engineers.

And, finally, we have seen painfully that the financial commitment to this investigation simply is not there. It is not uncommon to spend tens of millions of dollars investigating why a plane crashed. But we have yet to spend even a million dollars on this investigation, and the Bush Administration has refused to commit to release the full funding necessary.

But what difference does it make, some might ask? Who could have foreseen such a catastrophic event? Well, the same could be said, frankly, any time a plane crashes. Yet every time we learn about why one plane crashed, we save future people from being victims as well. We could learn what firefighters should know before they go into buildings. We should learn what families, like Vincent and Domencia Ragusa, who are from my district, who lost their son, a firefighter who went into that building unaware, as I am sure many of us, as we were, that those buildings were about to go down.

We can learn about future design of buildings. And, perhaps, as importantly, we might be able to revisit buildings that are currently standing and learn ways to make their occupants and firefighters safer. That is why I am going to be introducing legislation to give the National Institutes of Standards and Technology similar line authorities that the National Transportation Safety Board has. Whether it is a plane crash or a building collapse, we must get to the truth. Thank you, Mr. Chairman.

Chairman BOEHLERT. Thank you very much, Mr. Weiner. Mr. Hall.

Mr. HALL. Mr. Chairman, I will be brief because there are others who ought to speak, but I certainly join you and others here in our appreciation of those that are here. And Mr. Shea who is here representing Joe Allbaugh, who, I think, does a wonderful job for this country and a wonderful job for the President. And there is much——

Chairman BOEHLERT. As does Mr. Shea, a very long and distinguished career.

Mr. HALL. Yes. And there is much more to be done. I think it is more important for Anthony Weiner to be the spokesman here, and for Steve Israel, because they are sensible, sincere, caring. And, Sherry, you are the head of this Committee. You are going to see that New York gets that that—not as much as they are entitled to, but everything that we can do within our reach. And Mr. Grucci is doing a good job for his state.

I am just honored to be associated with these men and with the words Mr. Weiner has just spoken. It is a horrible time. It is a terrible time. We are battling an enemy with no Navy, no Marine Corps, no Army, no boundary lines. We don't know where they are. And I think it is a sorry, sad war, and it is a war nobody is going to come out the winner. We just have to hang together though. And, as a Democrat, I urge everybody to support the President. He is the Commander in Chief. We are at war. We are a Nation at war and we ought to be closer together than we are today.

I don't agree with everything anybody does, says, or thinks. I have my own mind. The day they struck those two buildings up there, I became a New Yorker. I am a New Yorker, and I appreciate every one of you and, God bless all of you. I want to yield whatever time I have left to Steve Israel, who has some words that need to be said. Thank you, Mr. Chairman.

[The prepared statement of Mr. Hall follows:]

PREPARED STATEMENT OF REPRESENTATIVE RALPH M. HALL

I want to join Chairman Boehlert in welcoming everyone to this afternoon's hearing.

Today's hearing will focus on the aftermath of the cowardly attacks on the World Trade Center and the Pentagon, which will rank as one of the great tragedies in American history. As with any tragedy we try to find some shred of consolation by looking to lessons that can help protect us against possible future tragedies. We need to carefully examine our emergency preparedness, evacuation procedures, and emergency response as well as the structural integrity of tall buildings as we sift through the events of September 11 in our search for meaning.

Today we will focus on the procedures and efforts to collect data at the World Trade Center site. I want to learn how we about the problems encountered by the structural assessment team and what changes need to be made to our procedures. I understand that we need to improve the coordination between all the Federal, state, and local agencies that were on-site. Important information was lost during the first month and we need to ensure this doesn't happen again. I also believe that NIST needs to play a more active role in the follow-up assessment and research that is required. NIST should serve as a pro-active liaison to the building code community to ensure that findings of the structural analysis in this case are reflected in our building codes.

I would like to thank the members of the FEMA Building Performance Assessment Team assembled by the American Society of Civil Engineers. These distinguished professionals have volunteered their time to work on this team. Volunteers from the Structural Engineers Association of New York have also assisted them. This isn't the first time a group of professionals have volunteered their time and expertise to serve on a FEMA assessment team. However, this is one of the few opportunities we have had to publicly thank them for their services. The FEMA team's report isn't due until April and their work is ongoing. It may be that the Committee has questions the witnesses don't feel ready to answer—I hope that we will keep at this issue so that we get answers as they become available. It is particularly important that we do follow-up work on any recommendations that the FEMA team offers. I hope this Committee will hold subsequent hearings to review the implementation plans for the research and analysis phase.

I would like to offer my condolences to the families of the victims of this tragedy, some of whom are at this hearing. You have suffered a terrible loss. This Committee will continue to follow the issue of disaster response and building safety to ensure that the lessons learned form the World Trade Center Disaster will be implemented to improve building safety codes, emergency response and evacuation procedures.

Chairman BOEHLERT. The Chair recognizes Mr. Israel for three minutes and 20 seconds.

Mr. ISRAEL. I thank the Chairman and I thank Ranking Member Hall for the time. And let me join with all of my colleagues in extending condolences to all of the families who suffered devastating losses, who have assembled with us today.

I represent in my district over 100 families who lost someone in the rubble of the World Trade Center. In the days after September 11, they wanted to know why our national intelligence and why our airport security wasn't strong enough to withstand an attack. And now, they are asking whether our steel was strong enough to withstand an attack, whether our building codes, our fire codes, our safety codes were strong enough to withstand the attack.

They want to know what we have learned from the collapse of the World Trade Center, what we learned from the collapse of the Federal Building in Oklahoma City. They want to know whether older buildings, buildings far older than the World Trade Center and the Murrah Building in Oklahoma City, have the steel and the safety codes that are necessary to withstand the same kind of catastrophic attacks that occurred at the World Trade Center.

Since September 11, we have responded to the assault on the World Trade Center and the Pentagon in many ways. Militarily, we have eviscerated al-Qaeda and the Taliban. We have started to revamp our airport security systems. We have passed a comprehensive Bioterrorism Act. And, even on Capitol Hill, as we came to this Committee hearing from voting on the Floor, we saw all sorts of new steel barricades and shatterproof glass that had been erected to protect Members of Congress.

But we are still asking our police and our fire, our rescue and our emergency services personnel around the country to risk their lives, rushing into buildings without really knowing what they need to know about the construction, the integrity, and the technical conditions that exist in those buildings. We need to know what could be done to make our buildings more structurally sound, what can be done to control intense fires caused by airplanes or bombs, what new precautions should be taken to minimize the weakening of steel, even under the most catastrophic conditions.

Mr. Chairman, I went, with many of my colleagues, to the wreckage of the World Trade Center only days after the attack with our President. We have an obligation to those who were lost in that rubble, and we have an obligation to everyone who walks into a skyscraper around our country to get some answers, and to get some answers today, and, even more vital, to act on what we learned. Protecting our buildings is just as important a homeland security and economic security issue as flying F-16s over Washington and New York.

I want to thank the Chairman for convening this hearing. I intend to work with the Chairman on a bipartisan basis to make sure that we are allocating the resources and the dollars necessary to study what happened on September 11 and to ensure that it never happens again. And I yield back the balance of my time, Mr. Chairman. Thank you.

[The prepared statement of Mr. Israel follows:]

PREPARED STATEMENT OF REPRESENTATIVE STEVE ISRAEL

Thank you Ranking Member Hall, and Mr. Chairman. I represent over 100 families who lost someone in the rubble of the World Trade Center.

In the days after September 11th, they wanted to know why our national intelligence and airport security wasn't strong enough to withstand the attack?

Now, they're asking whether building, fire and safety codes were strong enough to withstand the attack? They want to know whether we learned anything from the collapse of the Federal Building in Oklahoma City? Or, did bureaucracies simply file a report on some shelf, only to be opened in the scrutiny of September 11th? They want to know whether the Empire State Building or the Chrysler Building could have the same conditions that led to the catastrophe at the World Trade Center?

Since September 11th, we've responded to the assault on the World Trade Center and the Pentagon in many ways.

Militarily, we've eviscerated al Qaeda and we're pinpointing them even this week. . .we've replaced the Taliban theocracy with a secular interim government that will lead Afghanistan to democracy. . .we've started to revamp our airport security system. We passed a comprehensive bioterrorism act.

On Capitol Hill, we've erected steel barricades and shatter proof glass to protect members of Congress. . .but we're still asking our police, fire, rescue and emergency workers around the country to risk their lives, running into buildings without really, knowing what we need to know about the construction, the integrity, the technical, conditions of those buildings.

We need to know what can be done to make our buildings more structurally sound? What can be done to control intense fires caused by airplanes or bombs? What new precautions should be taken to minimize the weakening of steel even under the most catastrophic conditions?

Mr. Chairman, I went to the wreckage of the World Trade Center with President Bush a few days after the attack. We have an obligation to those lost in that rubble. . .and to everyone who enters a skyscraper in this new age of terrorist warnings. . .to shine some light, to get some answers, and even more vital, to act on what we have learned. Protecting our buildings is just as important a homeland and economic security issue as flying F–16s over New York and Washington.

That is why I intend to draft a letter with Representative Weiner asking the Office of Management and Budget to allocate the $40 million needed to complete a comprehensive study.

I thank the Chairman and Ranking Member Hall for holding this important hearing, and I look forward to getting answers to all these issues.

Chairman BOEHLERT. The Chair recognizes Mr. Grucci.

Mr. GRUCCI. Thank you, Mr. Chairman. And let me just start off by saying I associate myself with the remarks being made here today about the need to find out what went wrong, how it went wrong, and how to prevent it from going wrong in the future. You know, the tragedy of September 11 was one that one could never have predicted and never could have fathomed.

The extent to which our Nation was affected may never be completely understood, however, we continue to work together and to try and find the answers we can—and that we can muster. My Congressional district is located just 40 miles from Ground Zero. My constituents were some of the first responders, opening up their emergency rooms and volunteering their rescue services to their brothers, sisters, cousins, friends, and all that were trapped in the rubble. Close to 60 of my constituents were lost that fateful day. American sat with fear and awe, our eyes captivated by the horrific site of the World Trade Center Towers 1 and 2 crumbling to the city streets. These amazing skyscrapers were brought down by the powerful blast of jet airplanes carrying close to 10,000 gallons of jet fuel. The force of these blasts were enough to bring down a hundred stories of steel and concrete.

As the many brave and caring volunteers continue to clean up the horror and debris in lower Manhattan, Federal investigators continue to attempt to piece together as much information as possible. I am heartened that the Science Committee is taking a closer look at the engineering and structural investigations surrounding the collapse of the World Trade Center.

I look forward to the informative testimony from our expert witnesses to better understand the issues surrounding this tragedy. And I thank you, Mr. Chairman, and the Ranking Member for pulling this meeting together. I think today we will hopefully start to hear some of the answers that will bring closure to some people's minds as to what happened, but in order—and give us the ability to prevent these types of things from happening in the future. And I yield back the remainder of my time, Mr. Chairman.

[The prepared statement of Mr. Grucci follows:]

PREPARED STATEMENT OF REPRESENTATIVE FELIX J. GRUCCI, JR.

The tragedy of September 11th was one that no one could predict or even fathom. The extent to which our nation was affected may never be completely understood. However, we continue to work together and find what answers we can muster.

My Congressional district is located just 40 miles from Ground Zero. My constituents were some of the first responders, opening up their emergency rooms and volunteering their rescue services to their brothers, sisters, cousins, friends, and all that were trapped in the rubble. Close to 60 of my constituents lost their lives on that fateful September morning.

America sat with fear and awe, our eyes captivated by the horrific sight of World Trade Towers 1 and 2 crumbling to the city streets. These amazing skyscrapers were brought down by the powerful blast of jet airplanes carrying close to 10,000 gallons of jet fuel. Just to put that into perspective, if you converted the energy in the Oklahoma City bomb into jet fuel, it would amount to only 51 gallons of jet fuel. The force of these blasts was enough to being down over 100 stories of steel and concrete.

As the many brave and caring volunteers continue to clean up the horror and debris in Lower Manhattan, federal investigators continue to attempt to piece together as much information as possible.

I am heartened that the Science Committee is taking a closer look at the engineering and structural investigations surrounding the collapse of the World Trade Center. I look forward to the informative testimony from our expert witnesses to better understand the issues surrounding this tragedy.

Chairman BOEHLERT. Thank you very much, Mr. Grucci. And all members of the Committee will have five days in which to revise and extend their remarks. As is the practice of the Committee, we initially reserve five minutes for each side, Republicans and Democrats, for opening statement. And we ask our colleagues on the Committee to defer any opening statements so that we can get right to the witnesses and the task at hand to learn from their testimony, to probe, and to finally develop something that is responsive and responsible. And so all members will have five legislative days in which to revise and extend their remarks.

I would also point out that because of the extensive interest in this hearing, Room 2325 is an overflow room, and that, too, has a full house. And further, I would like to acknowledge the presence in the audience of a special group of people, the Skyscraper Safety Campaign, which is a project of parents and families of firefighters and World Trade Center victims. And they are here as very interested observers. We want you to know that our hearts and our prayers are with you, but you have every right to expect something more than our good intentions and our prayers. We are determined to go forward from this hearing to develop policy that will be responsive to a clearly identified need for our Nation and its future.

And I ask unanimous consent that everybody be allowed to introduce their statements to the record at this juncture. And without objection, so ordered.

[The prepared statement of Representative Constance Morella follows:]

PREPARED STATEMENT OF REPRESENTATIVE CONSTANCE MORELLA

Mr. Chairman, thank you for calling this important hearing. The events of September 11th shocked us all and many are still reeling from the after effects. Much of what was lost can never be made whole, and we will always have more questions than answers. However, it is important to do all we can to understand what happened and to take all reasonable steps to prevent such catastrophes in the future.

The attack on our nation was truly unprecedented, as was our response. We owe a great debt of gratitude to the men and women who risked their lives to respond to the crises, and their heroics will live in our memories for years to come. However, we must not forget to thank the many people who have worked tirelessly since then in the recovery effort and the research into understanding why the towers collapsed. Their work will have important consequences on future actions we take to safeguard the country against a repeat of the disaster. We have a number of these people here today and I want to go on record to thank them for their service to the nation.

However, despite their efforts, the investigation has not gone smoothly. As with everything of this size and scope, jurisdictional problems have arisen. The unusual nature of the crises has led to difficulties in accessing important records and prevented the timely sharing of information. It is our duty to investigate the causes of these problems and take steps to create the infrastructure needed to deal with events of this nature.

In addition, it is vital that we plan our future course of action. Initial reports on the collapse suggest more questions than answers and additional research is clearly needed. Fortunately, we have an advanced federal laboratory dedicated to research in building design and safety. The National Institute of Standards and Technology is uniquely positioned to conduct extensive investigations into the structural failures of the World Trade Center and suggest appropriate new standards and potential retrofits. In truth, NIST has already played a large and important role in the current investigation, but there is much more that can be done. I know Dr. Bement is here to discuss NIST's plans for the future and I urge my colleagues to listen carefully to his proposals.

We may never understand completely why the World Trade Center came crashing down on that September morning, but that should not prevent us from trying. Research into this disaster is the only way we have any chance of preventing the next one. I thank the panel for taking the time to come to Washington to share their insights and I look forward to their testimony. Thank you.

[The prepared statement of Representative Nick Smith follows:]

PREPARED STATEMENT OF REPRESENTATIVE NICK SMITH

I would like to thank Chairman Boehlert and Ranking Member Hall for holding this hearing today to examine the collapse of the World Trade Center buildings and the ensuing interagency efforts to respond to the disaster. The Federal Government has considerable experience handling a wide variety of disaster situations. Over the years, we have learned from earthquakes, hurricanes, large building fires, and bombings. All have provided information that has improved our ability to respond to these situations, and we have a sound framework in place for responding to national emergencies. There is no doubt that the efforts of agencies such as FEMA, NSF, and NIST, as well as many organizations outside of the Federal Government, have helped to greatly reduce losses of life and property from these national disasters, even well before the events of September 11th.

For example, the National Science Foundation has funded numerous projects over the years that have quietly helped to save lives in disastrous events. NSF-funded engineering research has brought forth technologies that have improved the ability of buildings to withstand seismic events and large fires. After the October 2001 anthrax attacks, it was NSF funding of sequencing of the anthrax genome that has been of great use in the investigation to find the attackers. At the site of the World Trade Center disaster, NSF-funded robotics expert Robin Murphy used innovative urban rescue robots to intelligently explore tight spaces in search of possible survivors. I think these types of applications that have emerged to help save lives underscore the importance of federally supported fundamental research to our economic and national security. I do not think the value of this basic research can be underestimated.

However, no one could have prepared for, much less predicted, an emergency situation of the magnitude and complexity that occurred on September 11th. The death and destruction caused by the hijacked 767 airliners slamming into the 110-story World Trade Center buildings was previously inconceivable. Immediately after the attacks, a number of government agencies and private organizations appeared on the scene to help in rescue, recovery, and sorting through the chaos. Among them were the FBI, New York Police and Fire Departments, FEMA, NIST, NSF, the National Transportation Safety Board (NTSB), and the Structural Engineers Association of New York (SEAoNY).

Recognizing that the World Trade Center cleanup was an unprecedented, multifaceted effort carried out under the most difficult of circumstances, I believe that the agencies and organizations involved performed very admirably. There are, however, many questions remaining regarding why the towers collapsed and how the ensuing investigation to determine why they collapsed could have been improved. For instance, why was important information such as building design plans was by and large unavailable, and why was research access to steel beams and other debris for the investigation delayed? Answering these questions may allow us to develop a clearer, enhanced protocol for responding to these situations, improve building and fire codes, and build safer buildings in general. All of these adjustments will move us closer to the ultimate goal: minimizing the loss of life and property during the occurrence of future natural disasters and terrorist attacks.

I hope that today's hearing will help to shed light on these unanswered questions. I would like to thank the witnesses for appearing before us today to discuss this issue, and I am looking forward to a productive discussion as we begin to move on in the aftermath of September 11th.

[The prepared statement of Representative J. Randy Forbes follows:]

PREPARED STATEMENT OF REPRESENTATIVE J. RANDY FORBES

Thank you Mr. Chairman, and Ranking Member Hall, for holding this important hearing today. Next Monday will mark the six-month anniversary of the tragic attacks on the World Trade Center Towers and the Pentagon. Since that time, we have come together as a nation and as a Congress.

The impact of 9/11 has required all of us in Congress to re-evaluate not only how we view the world, but how we ensure the safety of our citizens as well. I can think of no greater obligation of the Federal Government than to protect its citizens. Since 9/11, Congress has responded by passing legislation to protect our borders, increase our ability to defend and respond to attacks of bio-terrorism, and strengthen our airport security and airline industry. Clearly we are a safer nation than we were six months ago. With that said, one area Congress has yet to examine closely is how the Federal Government investigates and responds to large-scale disasters. What can engineers, builders, and designers learn from the collapse of the World Trade Center Towers that can be used to save lives through improved building construction?

I am concerned that no clear protocol was in place for building investigators who were attempting to understand how the two buildings collapsed. While I understand that Ground Zero is first and foremost a crime scene and rescue area, we must also allow investigators the ability to fully examine evidence that will give us a greater understanding of why the buildings collapsed. I was disappointed to learn that investigators were unable to examine recovered pieces of steel from the Twin Towers before they were recycled. I am also troubled that investigators had difficulty in obtaining blueprints, design drawings, and maintenance records because of liability concerns from the buildings' owners. These records are invaluable in fully understanding how the buildings collapsed.

I hope today's hearing will help us strike a balance between investigating a crime scene and conducting an engineering investigation. While we will never live in a world that will be completely immune from despotic acts of terrorists, we should remain eternally vigil in our efforts to ensure that safety of all Americans. Again, I thank the Chairman for holding this important hearing today and I look forward to hearing from our witnesses.

[The prepared statement of Representative Jerry F. Costello follows:]

PREPARED STATEMENT OF REPRESENTATIVE JERRY F. COSTELLO

Good afternoon. The events of September 11th have had a profound effect on America in many ways. In addition to reevaluating our safety and security, we have been left with many procedural and scientific questions. I want to thank the witnesses for appearing before our committee to discuss the data collection procedures in the aftermath of the World Trade Center attacks and the follow-up research needed to better understand the structural causes of the building collapse, building evacuation procedures, and possible changes to building codes.

Immediately following the attacks on the World Trade Center and the Pentagon, the Federal Emergency Management Agency (FEMA) assembled a Building Performance Assessment Team (BPAT) comprised of 23-members. They were charged with determining the structural causes of the World Trade Center collapse, including the collection of steel beams and other structural components. Because of the unprecedented nature of the World Trade Center attacks, nothing had prepared our investigators for a disaster of this magnitude and complexity, involving many buildings and a massive debris pile in a small, confined area. The investigation was also hampered by the one month delay in collecting data from the actual site because of the search and rescue efforts and criminal investigation activities. However, once the BPAT gained access and arrived on-site, the process worked according to procedure resulting in an orderly recovery effort. The FEMA BPAT encountered numerous obstacles during its investigation, including an inability to examine the steel, either removed from the site during the early search and rescue work or shipped to recycling plants, and the denial of access to building design, construction, and maintenance documents. I am particularly interested to know what needs to be changed or improved to allow teams, like BPAT, to do their job.

In addition, as you are all well aware, coordination among federal agencies is critical for gauging our preparedness and responding to national disasters. The National Science Foundation (NSF) and the National Institute of Standards and Technology (NIST) also took part in the collection of the World Trade Center site data. NSF gave grants to eight research projects to begin studies of the World Trade Center site to study the social science aspects of the human response, testing new technologies to assess infrastructure damage, and collecting structural engineering data. Although NSF did not coordinate its research with the BPAT, I am interested to know if research done by NSF can be used in the BPAT assessment and if it will factor into the BPAT recommendations. Also, FEMA has initiated discussions with NIST for NIST to take the lead on the follow-on activities recommended by the BPAT. NIST has developed a 4-year follow-on comprehensive research plan and an estimated cost in order to take the lead on research once the FEMA's BPAT issues its report. I want to know the role FEMA's team played in developing this research plan with NIST.

I welcome our witnesses and look forward to their testimony.

[The prepared statement of Representative John B. Larson follows:]

Prepared Statement of Representative John B. Larson

I want to thank the Chairman for convening this important hearing. Before I ask my questions I want to recognize the presence today of the organizers of the Skyscraper Safety Campaign, an effort of Sally Regenhard, whose firefighter son, was killed at the World Trade Center, and which represents over 3,000 members and is endorsed by the major 911 Victim Family groups. In particular I want to welcome Ms. Monica Gabrielle from my home state of Connecticut, who lost her husband, Richard, as a result of the collapse of 2 World Trade Center. My condolences to you and the other members of the Skyscraper Safety Campaign who are here to ensure that we know all we need to know about the structural collapse, the subsequent investigation, and to make sure that any recommendations are followed through and implemented so that we can avoid preventable deaths. I commend and welcome your and your group's efforts.

In the aftermath of the terrible collapse and the subsequent investigations that followed, several factors have become clear:

1. There was no clear authority or effective protocol for how the building performance investigators should conduct and coordinate their investigation with the concurrent search and rescue efforts, as well as any criminal investigation;
2. There was difficulty obtaining documents essential to the investigation, including blueprints, design drawings, and maintenance records;
3. There is uncertainty as a result of the confidential nature of the Building Performance Assessment Team (BPAT) study; and
4. There is uncertainty as to the strategy for completing the investigation and applying the lessons learned.

Obviously, if we are to prepare adequately to meet the tremendous challenges posed by the potential that another tragedy of this magnitude takes place the issues outlined above need to be cleared up. Yet it is troubling to me that we are not close to meeting that goal. So far the "facts on the ground" from what I can gather based on information in the public record are:

- The American Society of Civil Engineers team, whose report is due in April, admits they may have lost data due to the decision to recycle the structural steel.
- It isn't known whether the National Science Foundation studies can be incorporated into the ASCE recommendations because there was no coordination between them.
- ASCE admits that its investigation is not comprehensive, but that their report will include recommendations on what to do about the issues not addressed in their report.
- The Building Performance Assessment Team (BPAT) will recommend that a federal agency needs the authority to have on-site personnel to direct data collection efforts.
- BPAT had no legal authority to require the plans be given to them. The BPAT will recommend that subpoena authority be given to some federal agency to allow access to all information/data required for a BPAT investigation (neither FEMA nor NIST wants it, however).
- Although NIST has the most expertise of any federal agency in building and fire safety, it has no formal role to play in the follow-on disaster analysis. After a BPAT team releases it preliminary report, there is no formal mechanism to ensure its recommendations are actually implemented.

- There is no comprehensive central repository for all information that is gleaned from an investigation of this kind.

If this is all true, then it is clear that as a starting point, Congress needs to accomplish two things:

(1) we need to find a way to fund NIST's proposal for a 2-year follow-on comprehensive research plan, which would address building design, structural analysis of the building collapse, emergency response procedures, evacuation procedures and proposed changes to building standards based on research findings; and

(2) we also need to establish mechanisms for following-through on implementation of any recommendations, guidelines or standards that are established as a result of these investigations.

We here in Congress need to make sure we assert our role in making sure this process moves forward and those mechanisms are in place. I am aware of the fact that not all of the answers we need will be available at this hearing and that not all the steps that should be taken to reduce the likelihood that something like this can happen again in the future will be identified at this hearing. This should only be the start to what I believe should be a public and open process which will lead to significant changes in how we provide for the safety of citizens of this country.

[The prepared statement of Representative Bob Etheridge follows:]

PREPARED STATEMENT OF REPRESENTATIVE BOB ETHERIDGE

Thank you, Mr. Chairman. I commend you for holding this important hearing on an event that effects every American and our nation. I would like to offer my condolences to the families of this tragedy.

This is a very difficult subject. The tragedy that the United States experienced on September 11, 2001 was unparalleled with any prior accident or disaster. The collapse of the World Trade Center towers was the largest structural building disaster in human history. A disaster of such epic proportions demands a full comprehensive, detailed investigation.

I am struck by the rapidity in which the World Trade Center towers collapsed. Aside from withstanding enormous wind loads, the World Trade Center towers were also constructed to withstand settlement loads. Because the towers were built on six acres of landfill, the foundation of each tower had to extend more than 70 feet below ground level to rest on solid bedrock. Although the towers were in fact designed to withstand being struck by an airplane, they were unable to survive the effects of a direct hit by the two hijacked commercial jetliners and the fires that resulted weakened the infrastructure of the building, collapsing the upper floors and creating too much load for the lower floors to bear. In trying to comprehend how this actual happened, I am compelled to ask if there is any reason to have concern on how other tall buildings are constructed in this Country and the safety of the people occupying them.

While I applaud the FEMA Building Performance Assessment Team and other federal agencies for the service they provided, the investigation clearly shows that a comprehensive plan was not in place for disaster investigations. There is a need to have a comprehensive plan in place to handle large-scale investigations.

Chairman BOEHLERT. We will proceed right to our panel of very distinguished witnesses.

Mr. Robert Shea, Acting Administrator, Federal Insurance and Mitigation Administration; and, Mr. Craig Wingo, Director of Division of Engineering Science and Technology, from the Federal Emergency Management Administration. Dr. W. Gene Corley, American Society of Civil Engineers, Chair of the Building Performance Assessment Team, which we will constantly refer to as BPAT, reviewing the WTC disaster. Professor Glenn Corbett, Assistant Professor of Fire Science at John Jay College, New York City. Dr. Astaneh, Professor, Department of Civil and Environmental Engineering, University of California. And Dr. Arden

Bement, Director of National Institute of Standards and Technology.

As the Committee clearly can appreciate, we have a panel of very distinguished witnesses, and we look forward to hearing your testimony. We would appreciate, as is customary, that you try to summarize your statement in five minutes or so. We have all had the advantage of your full statement, which will be in the record at this juncture. And I would imagine that my colleagues have joined me in reading this testimony in preparation for this important hearing. The Chair is not going to be arbitrary. This is too important to let a minute or two interfere with making an important point, but we would appreciate your summarizing your testimony. We have six distinguished witnesses and we have a number of very interested Members of Congress who want to have a dialogue with you. And let me thank you for serving as resources for this Committee. Mr. Shea, you are up first.

STATEMENT OF MR. ROBERT F. SHEA, ACTING ADMINISTRATOR, FEDERAL INSURANCE AND MITIGATION ADMINISTRATION, AND, MR. CRAIG WINGO, DIRECTOR OF DIVISION OF ENGINEERING SCIENCE AND TECHNOLOGY, FEDERAL EMERGENCY MANAGEMENT ADMINISTRATION

Mr. SHEA. Thank you, Mr. Chairman, and the members of the Committee. As you indicated, I am the Acting Administrator of the Federal Insurance and Mitigation Administration. I am here today because Joe Allbaugh asked me to be here to address this Committee. With me is Craig Wingo, who is my Senior Executive in charge of my Engineering Sciences and Technology Division. Mr. Wingo is also the executive that I hold responsible for the Building Performance Assessment Team activity. I will be making the statement and Mr. Wingo will not at this point.

I respectfully request that my written testimony be entered into the record and that I be allowed a few minutes to make a few verbal comments. If that meets with the approval of the Chair and the Committee, I will proceed.

FEMA operates under the authority of the Stafford Act to respond to disasters. This is an immensely powerful mechanism. Am I still missing here? Okay.

Chairman BOEHLERT. Pull the microphone closer, if you will so we——

Mr. SHEA. I will do that.

Chairman BOEHLERT. We have a crowded room and we want to make certain——

Mr. SHEA. Is that better, Mr. Chairman?

Chairman BOEHLERT. That is much better. Thank you.

Mr. SHEA. Okay. This is an immensely powerful mechanism you respond to disasters. Embedded in the Act is our charter that provides supplemental support to the efforts and available resources of state and local government. But clearly recognizing their primacy.

Further, as FEMA operates under the aegis of the Federal Response Plan, the way the Federal Government responds to catastrophic events. Huned from over 30 years of experience, this Plan allows FEMA to coordinate the relief and recovery efforts of the combined assets of the entire Federal Government and state and local governments, but particularly, by relying on existing expertise and capability.

In a large part, we are doers, but we conduct our business by coordinating. For example, under the Plan, one of the emergency support functions is led by the Corps of Engineers, not by FEMA. Further, in this effort, emergency support function nine became the primary example of our level of effort to provide support. It is called Urban Search and Rescue. Essentially, this is highly trained and equipped local fire forces from across the country. So relying on resources and expertise provides for a very effective response system which is also highly efficient.

In the immediate aftermath of this event, FEMA's singular focus was a search and rescue recovery of victims and, frankly, re-establishing the viability of the New York Fire Department.

Last week, I spent some time with Chief Nick Russo, a 29-year veteran of the Hull, Massachusetts Fire Department. Chief Russo watched the events that day and understood the impact on the New York firefighters. So he gathered six other chiefs from his area and was at Ground Zero within hours. His role was to aid in the restructuring of the incident command and also perform search and rescue. Chief Russo told me that his mission matched exactly that of FEMA.

Further, when it became painfully clear that the operation had shifted to the recovery of the victims, that became the single focus of the federal, state, and local efforts. The efforts to recover victims lasted throughout September and into early October and it still continues. Nonetheless, on September 12, the day afterwards, FEMA and the American Society of Civil Engineers began collaborating on the implementation of a Building Performance Assessment Team. The National Institute of Standards and Technology was a partner in this pursuit.

The role of the BPAT is two-fold—to aid in the recovery process through a rapid assessment in order to incorporate mitigation measures into the rebuilding process, but, frankly, limited in scope, to Stafford Act authorities—that is, to the rebuilding process of the affected facilities.

Secondly, though, as we go through that process, to use the products of this effort to influence building practices through changes to building codes. The BPAT, or Building Performance Assessment Team, process does not lend itself to complex, long-term studies and it was never intended to do so.

Because of the limited resources of expertise, FEMA uses the same philosophy as the Federal Response Plan. We look to other authorities and expertise in other Federal agencies for those missions. In this case, the appropriate agency is the National Institute of Standards and Technology. They should conduct the long-term, complex studies that must naturally flow from this initial BPAT effort. In my opinion, appropriate studies of the complex issues presented in this fire and structural collapse, will take years to complete.

Let me also say that I have not seen a draft of the BPAT report. But it is important, in my opinion, as well, to preserve the scientific and technical integrity of this study. Jumping to conclusions will ultimately serve no one well in the end.

At this point, it is my understanding that the conclusions associated with this report have not yet been finalized. Therefore, while I cannot share insights about the causal factors of the collapse of the World Trade Center, from either a fire or structural point of view, I would like to share these observations, which are based on my experience of 25 years.

In this country, we build buildings to a minimum standard. They are probably the best in the world, but they are, in fact, to a minimum standard. What we learn from this tragedy is probably beyond the current generation of buildings. But we can influence the next generation of buildings. So I believe it would be prudent to carefully pursue our eventual conclusions.

Second, the World Trade Center was a tragedy. And, frankly, it was an anomaly. No one who viewed it that day, including myself, believed that those towers would fall. Our collective thought process for laymen and engineers and firefighters changed that day forever.

While the results are still being analyzed and years of study may lie ahead, I can still make the following general observations associated with these types of buildings. Firefighters in many communities are involved with a building code enforcement process, but this is frankly not universally the case. So we need to think more broadly, as all of us have had to be challenged after the events of September 11.

Not only should fire and structural engineers be involved, but we also need firefighters inspecting buildings during the construction process. And the reason is very straightforward. When experienced firefighters look at the construction process, they can tell you what the failure mechanisms will be if they ever have to go into that building and fight a fire.

Secondly, we need to thoroughly explore and embrace the idea of redundant fire systems or in-place protection systems for high-occupancy vehicles.

Thirdly, there was a failure of firefighter communication systems during the event, and it continued well into the search and rescue efforts. It was literally observed that as the search and rescue efforts were going on, there were handwritten notes being passed in order to effect communications.

Clearly, the issues that I have just outlined need to be addressed in the longer-term research effort. I thank you, Mr. Chairman, and I appreciate the time.

[The prepared statement of Mr. Shea follows:]

PREPARED STATEMENT OF ROBERT F. SHEA

Mr. Chairman, Members of the Committee, I appreciate the opportunity to appear before you today to discuss FEMA's response to the World Trade Center attacks. My name is Robert Shea, Acting Administrator for the Federal Insurance and Mitigation Administration, and I am here representing Joe Allbaugh, the Director of the Federal Emergency Management Agency.

On September 11, 2001, the United States of America was suddenly and savagely attacked by terrorists precipitating the worst disaster in the history of our nation. The tragic loss of life in the collapse of the World Trade Center towers and the destruction at the Pentagon exposed many vulnerabilities to our population and infrastructure within our borders which could be exploited by terrorists and others seeking to harm our country.

Within hours of the terrorist attacks, President Bush had mobilized the Federal government and declared disasters, making Federal support and assistance immediately available to the City and State of New York as well as to the Commonwealth of Virginia. As you know, FEMA helps the nation prepare for, respond to, and reduce the impact of, man-made, natural, and technological hazards including catastrophic events, such as the Alfred P. Murrah Building bombing, the Northridge Earthquake and preparing for Y2K and the Winter Olympics. September 11th was a "wake up" call for our nation and the entire world. In the war on terrorism, FEMA has a clear mission: to make certain that the United States of America becomes "A Nation Prepared."

FEMA's role as an emergency responder was tested but we were able to draw upon decades of experience in hundreds of disasters and the solid relationships that we have forged with States and local governments and other Federal agencies. That experience and those relationships were vital during the first days and weeks following September 11th and enabled FEMA to provide the critical support requested by the City and State of New York to local emergency responders and law enforcement officials. This support included the critical urban search and rescue, debris removal, technical assistance and other emergency measures. The U.S. Fire Administration, an integral part of FEMA, has been providing training to firefighters and emergency responders in initial disaster response and incident command and control—skills that were fully evident at ground zero.

Under the Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended, FEMA has the lead coordination role for Federal disaster response, which is managed through the Federal Response Plan (FRP), involving the 27 Federal agencies, local agencies, and other groups. This national plan, perfected during the last decade, made it possible to effectively support local law enforcement and supplement the response activities undertaken by the City and State of New York. As for the World Trade Center disaster, the City and State of New York drew upon as many assets as they could, both governmental and private, to rescue and protect their citizens. FEMA has acted in its traditional support role, mindful of the extensive capabilities and the sovereignty of the City and State of New York.

The Federal Response Plan establishes a process and structure for the systematic, coordinated, and effective delivery of supplemental assistance to address the consequences of any major disaster or emergency declared by the President. Within hours of the September 11th attacks, the FEMA Emergency Support Team center was up and running and, implementing the 12 Emergency Support Functions (ESF's) described in the FRP, already coordinating and organizing the Urban Search and Rescue teams, and setting up the Disaster Field Office on-site in New York City.

The most vital Emergency Support Function in response to this tragedy was Urban Search and Rescue (US&R). Because the mortality rate among trapped victims rises dramatically after 72 hours, search and rescue must be initiated without delay. US&R rapidly deploys components of the National US&R Response System to provide specialized lifesaving assistance to State and local authorities in the event of a major disaster or emergency. US&R operational activities include locating, extricating, and providing on-site medical treatment to victims trapped in collapsed structures, and engineering evaluation of structures for safety and building integrity.

A key member of the US&R team is the structural engineer, who must make constant judgments about the structural stability of debris and damaged buildings as the team rescues trapped individuals. As the US&R teams searched through the mountains of twisted steel and concrete, these engineers made safety judgments related to the creation of access points. With engineering expertise coming to New York City from across the country and present within city agencies of New York, the initial response activities were able to pull from an extraordinary pool of local engineering support. During the initial response, engineering support included:

1. Ensuring equipment, such as cranes, was safely located on stable bases to support rescue efforts;
2. Quick and continuing evaluation of the safety of surrounding buildings, infrastructure and the site;
3. Monitoring changes at the site through surveying; and
4. Remote sensing using satellites, and supporting rescue workers on the site by continually reporting this information at shift briefings, site inspections and visits, and through sophisticated Geographical Information Systems producing up-to-date information and maps.

FEMA's United States Fire Administration also responded to directly assist the New York City Fire Department to re-establish its Incident Command structure, had been tragically lost when the towers collapsed. The forward deployed team assisted in coordinating daily mission planning and logistics for the first three weeks until FDNY was ready to fully resume that role. USFA is also working with the fire department on a training needs analysis to help restore FDNY to its full capacity as it takes on over 400 new firefighters. This, in addition to the US&R, demonstrates FEMA's linkage to the first responders in a catastrophic event.

FEMA's singular goal in the immediate aftermath of the attack was to support local jurisdictions in the rescue of trapped firefighters and workers. As soon as practicable, and without impeding the rescue effort, FEMA began coordinating with State and local governments and private organizations on the next important steps: the short-term and long-term recovery.

FEMA has an established role in recovery: to provide grants to State and local agencies and individuals, as well as coordinating the efforts from other Federal agencies with State, local and charitable organizations in order to help communities and individuals rebuild their lives. Another critical component is the technical assistance that FEMA can bring to bear to not only facilitate a quick recovery but to influence the recovery by giving special consideration to particular aspects of a building or the infrastructure. Although meeting the human needs is paramount, investigating and understanding this enormous and complex disaster can provide benefits for the City of New York's recovery as well as the entire nation.

FEMA has long been an advocate of conducting engineering studies to learn lessons from disasters, whether man-made or natural. In response to hurricanes, floods, earthquakes, and other disasters, including man-made disasters, FEMA often deploys Building Performance Assessment Teams (BPATs) to conduct field investigations at disaster sites. The BPAT is typically employed to determine failure mechanisms of buildings in the aftermath of a disaster so strategies can be developed to increase the disaster-resistance of structures. However, since this event was larger and more complex than any we have ever experienced, the objective of this BPAT is to probe the numerous issues related to structural collapse and fire so that we may make preliminary conclusions and recommendations for more intensive investigation and research.

Immediately following the September 11th attacks, FEMA reached out to the engineering and fire communities to coordinate any post-event studies or evaluations of building performance, incident command, communications or other similar efforts. Within 24 hours, FEMA was in contact with the American Society of Civil Engineers, which was already assembling a team of national experts, drawing talent from a variety of engineering, research and scientific groups that had volunteered to help. This team approach, which is frequently utilized for disasters, has been highly effective for ensuring a multidisciplinary approach with equal voices and inputs from the various sectors. For our World Trade Center evaluation, FEMA and ASCE immediately collaborated on the development of the team analogous to our approach during our study of building performance after the Northridge earthquake. The team of experts was assembled based on what appeared to be the likely failure mechanisms for the World Trade Center towers, namely, fire and structural collapse. There are over twenty national and international experts on this team with knowledge in: building and fire testing; computer modeling of structures and fire; design of tall buildings; steel construction; concrete construction; fire safety; fire protection; and codes and standards. As you know, the National Institute of Standards and Technology (NIST) has along-established history of investigating building collapses and fires and a mission of research and testing that results in standards and guidance that makes the United States safer and its industries more competitive. FEMA asked NIST to join the BPAT during its formation in September because of NIST's technical expertise and to ensure a smooth transition between FEMA's short-term study and any long-term investigation and research conducted by NIST.

Because of the importance of the rescue effort at the World Trade Center complex, it was clear that information would have to be gathered without interfering with response and rescue activities. Based on this fact, the FEMA–ASCE team first visited the site on October 6, but gathered information from others who had been onsite before this date. This information included plans, photographs, videotapes, eyewitness accounts from rescue workers and reports from the New York City Department of Design and Construction. In addition, the Structural Engineers Association of New York, in support of the City and as a formal member of the BPAT, located and identified specimens of steel for use in future studies. FEMA is coordinating with NIST to make sure that these specimens are properly stored and available for future testing. Also, it is important to note that there are, literally, thousands of plans, specifications and other documents for the World Trade Center. Although it took some weeks to obtain the plans, the owners were fully cooperative with our requests.

Focusing on the areas of fire protection and structural performance, the BPAT team has been gathering evidence and studying designs so that when the report is published, its conclusions and recommendations will help guide future investigative and research efforts connected primarily to understanding the performance of buildings when subjected to extreme conditions.

This study represents an important first step in suggesting how the technical resources of the nation can be brought to bear on protection of lives and property. Because of the importance of this initial report, FEMA and ASCE have compressed in half a schedule that normally takes over a year to complete, which will result in the issuance of a report in early spring. The report will not only make preliminary observations and conclusions about the structural and fire related performance of the World Trade Center towers, but will have six additional chapters that discuss damages and lessons learned from surrounding buildings such as World Trade Center 7, as well as numerous technical appendices.

The National Institute of Standards and Technology (NIST) has the authority and technical expertise to conduct investigative studies of the causes of the collapse and other related matters. The USFA and the Federal Insurance and Mitigation Administration of FEMA will work closely with NIST as it undertakes this ambitious agenda.

USFA will also be looking at the lessons that can be learned from this incident by the nation's first responders. USFA has a long history of doing reports on major incidents and their impacts on the fire service, with a special emphasis on incident command, fire protection systems, evacuation planning and response, communications, and overall fire fighting and rescue response.

Finally, FEMA is currently working with NIST to develop a Memorandum of Understanding (MOU), which will help to guide our future collaborations on similar types of studies. For these types of extreme events, whether natural or man-made, the MOU will serve as a road map to establish protocols for future collaboration of our two agencies under our respective authorities.

I would now be pleased to answer any questions that the Committee may have.

BIOGRAPHY FOR ROBERT F. SHEA

Robert F. Shea was appointed Acting Administrator of the Federal Insurance and Mitigation Administration in August 2001 after an agency-wide reorganization. Previously, Mr. Shea was deputy administrator for mitigation in FEMA. In his acting capacity, Mr. Shea is responsible for overseeing the insurance and risk reduction activities of FEMA, including educating residents and state and local official about the importance of risk reduction activities. Mr. Shea also coordinates efforts to educate the public on the importance of insuring property against flood damage.

Previously, Mr. Shea served as the Division Director for the Program Support Division within FEMA's then-Mitigation Directorate. In that capacity, he provided executive direction to the Hazard Mitigation Planning Program, the Hazard Mitigation Grant Program and the Flood Mitigation Assistance Program.

Mr. Shea has spent 25 years in emergency management in FEMA, serving in various capacities, including chief of the Coordination Office of the former State and Local Program and Support Directorate and chief of the Program Development Division in the former Office of Earthquakes and Natural Hazards.

A native of Atlanta, Ga., Mr. Shea earned Bachelor's and Masters's degrees in English Literature from The Catholic University of America.

Chairman BOEHLERT. Thank you. Mr. Wingo, I assume Mr. Shea speaks for you also. Dr. Corley.

Mr. WINGO. Mr. Chairman, thank you.

STATEMENT OF DR. W. GENE CORLEY, P.E., S.E., SENIOR VICE PRESIDENT, CTL ENGINEERING, CHICAGO, ILLINOIS, ON BEHALF OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS, CHAIR OF THE BUILDING PERFORMANCE ASSESSMENT TEAM REVIEWING THE WTC DISASTER

Dr. CORLEY. Good afternoon, Mr. Chairman, and members of the Committee. My name is Gene Corley. I appear before the Committee today on behalf of the American Society of Civil Engineers. In my volunteer capacity—at ASCE, I serve as Chair of the Building Performance Assessment Team, which is studying the collapse of the World Trade Center. I am employed by CTL, an engineering firm in Chicago, Illinois, as Senior Vice President.

The tragic events of September 11 have served as a grim reminder that there is no limit to the destructive forces that man can use to damage or destroy the Nation's infrastructure. We all personally mourn those lost in the attack.

On the afternoon of September 11, the Structural Engineering Institute of the American Society of Civil Engineers began assembling two teams of experts to study the performance of the buildings at the World Trade Center complex and at the Pentagon. The goal of the studies is to increase our knowledge and understanding of how buildings subjected to extreme forces, such as those caused by the crash and resulting fires, perform under these unprecedented circumstances.

Studies of this type were performed by ASCE six times in the year 2000, following other disasters. ASCE provides the internal mechanism to organize and fund these studies. In 1995, ASCE, in partnership with FEMA, organized a team that I headed to examine the Murrah Federal Building in Oklahoma City and the surrounding area after that bombing. The teams assembled by SEI/ASCE and a coalition of professional organizations that joined us, are comprised of academics and other leading experts in the fields of structural analysis and design, fire engineering, blast effects, and building materials. On October 1, the WTC study became a joint effort between ASCE and the Federal Emergency Management Agency, a partnership which continues to this day.

The partnership with FEMA has been very beneficial to the overall progress of the WTC team. In addition to providing funds, FEMA has provided logistical assistance, organizational and operational guidance, assistance in obtaining and organizing the needed data, and will provide the research to publish the report.

Team members have examined structural debris from the Fresh Kills Landfill in Staten Island and at two recycling yards in New Jersey. Samples of the structural steel were obtained and have been subjected to laboratory analysis. They are presently being stored at the National Institute of Standards and Technology in Gaithersburg, Maryland, for use in future studies.

In the 10 years in which ASCE has been conducting studies of disasters, we have learned that our teams will always encounter impediments. However, we have also learned that with time and persistence, these difficulties are either overcome or an alternate approach is found to enable a team to satisfactorily complete their study.

Delay in the receipt of plans did, somewhat, hinder the team's ability to confirm our understanding of the buildings. Through the efforts of FEMA and others, the team received the engineering plans for the towers on January 8 of this year and work is proceeding.

There has been concern expressed by others that the work of the team has been hampered because debris was removed from the site and has subsequently been processed for recycling. The team has had full access to scrap yards and to the site and has been able to obtain numerous samples. At this point, there is no indication that having access to each piece of steel from the World Trade Center would have made a significant difference to understanding the performance of the structures.

Resources are always an issue with building performance studies, particularly one whose magnitude and scale is unprecedented. The total amount of resources being dedicated to support the team's activities is approximately $1 million, plus an estimated additional million dollars in volunteer time by our team members. This support has allowed the team to do the initial reconnaissance of the site and the building materials, begin the process of hypothesis-setting, and conduct some limited testing. It is our opinion that $40 million or more is needed to fully fund the necessary additional comprehensive study.

As many in the United States and the world examine the future of tall buildings, it is important to look at how well these buildings performed under extreme circumstances. It must be remembered that large commercial aircraft hit the World Trade Center towers, yet, both withstood the initial impact.

Efforts such as those being conducted by the Building Performance Study Teams and studies emanating from this initial study will seek to extend the performance of structures to allow occupants and rescuers time to reach safety.

There are two high-priority needs from the structural engineering community which I would like to draw your attention. The first is the issue of progressive collapse. The second is the issue of fire structure interaction. We believe that each of these needs are crucial to advancing the health, safety, and welfare of the citizens of our Nation. The work will require a substantial partnership between public agencies, such as NIST, and private organizations, such as ASCE, and our coalition partners.

Thank you for the opportunity to express ASCE's views. We offer Congress and all the agencies involved in the recovery efforts ASCE's full resources to manage the Nation's critical infrastructure needs. We are ready to help in any way possible.

[The prepared statement of Dr. Corley follows:]

PREPARED STATEMENT OF DR. W. GENE CORLEY

Senior Vice President, CTL Engineering, Chicago, IL; On behalf of the American Society of Civil Engineers

The tragic events of September 11 have served as a grim reminder that there is no limit to the destructive forces than man can use to damage or destroy our nation's infrastructure. The civil engineering profession, as stewards for our nation's infrastructure, feels obligated to make certain the critical public works our communities and nation depend on are protected. Through the American Society of Civil Engineers (ASCE), the profession has taken a leading role in addressing infrastructure vulnerability and is developing both short- and long-term strategies to mitigate the impact of future disasters on our critical civil infrastructure.

Founded in 1852, ASCE represents more than 125,000 civil engineers worldwide and is the country's oldest national engineering society. ASCE members represent the profession most responsible for the nation's built environment. Our members work in consulting, contracting, industry, government and academia. In addition to developing guideline documents, state-of-the-art reports, and a multitude of different journals, ASCE, an American National Standards Institute (ANSI) approved standards developer, establishes standards of practice such as the document known as ASCE 7 which provides minimum design loads for buildings and other structures. ASCE 7 is used internationally and is referenced in all of our nation's major model building codes.

In response to the events of September 11th, ASCE is implementing a multi-faceted response plan, significant elements of which are outlined here. Following this abbreviated outline of our initiative is a more detailed discussion of ASCE's efforts related to the World Trade Center.

ASCE's Critical Infrastructure Response Initiative

On October 9, 2001, the ASCE Board of Direction voted to expend money from reserves on a Critical Infrastructure Response Initiative (CIRI). The objective of CIRI is to establish strategies and guidelines for:

1. Assessing U.S. infrastructure vulnerability.
2. Using the results of vulnerability assessments to prioritize infrastructure renovation.
3. Identifying research and development needs for new approaches to protecting critical infrastructure.
4. Developing retrofit designs to mitigate damage from disasters.
5. Developing new approaches to design and construction.
6. Improving disaster preparedness and response.

To accomplish the CIRI objectives, ASCE has undertaken the following activities:

1. Review and evaluate existing and pending legislation regarding infrastructure, and provide appropriate input.
2. Identify existing and pending infrastructure initiatives by other professional and technical associations to identify opportunities for partnering, and to avoid duplication of efforts. For example, EPA has several water supply initiatives underway with AMWA. These initiatives, however, are currently focused on operations and management, and ways will be sought to provide input regarding design and construction issues.
3. Identify existing and pending infrastructure initiatives by federal agencies to identify opportunities for partnering.
4. Create a liaison or partnership with the Office of Homeland Security regarding the assessment of infrastructure vulnerability and the design and construction of mitigation measures.

In each of these areas, ASCE stands ready to assist other organizations, both public and private, to reduce the vulnerability of our nation's infrastructure.

ASCE's Efforts Related to the World Trade Center

Building Performance Study Teams

On the afternoon of September 11, 2001, the Structural Engineering Institute of ASCE (SEI/ASCE) began assembling two teams of experts to study the performance of the buildings at the World Trade Center Complex and the Pentagon. The goal of the studies is to increase our knowledge and understanding of how buildings subject to extreme forces, such as those caused by the crash and resulting fires, perform under these unusual circumstances.

The scope of the WTC study team is quite broad. Although much of the Nation's attention has been riveted to the collapse of the twin 110-story towers, the WTC team is also examining several of the buildings in the surrounding area to determine what lessons might be learned from the performance of those structures as a result of their being impacted by falling debris and ensuing fires. Of particular interest to the engineering community is the performance of WTC 7 and the Banker's Trust Building.

Studies of this type have been performed by ASCE following other disasters under the authority of ASCE's Disaster Response Procedure, which provides the internal mechanism to organize and fund these studies. This was the fifth time in 2001 that the procedure was used to create study teams. Earlier teams, whose members were experts in earthquakes and lifeline engineering, were dispatched to study and document the damage from the earthquakes in El Salvador, India, Seattle, and Peru. In 1995, ASCE, in partnership with FEMA, organized a team to examine the Murrah Federal Office Building in Oklahoma City and surrounding area after the bombing.

Team Members and Partnering Organizations

The teams assembled by SEI/ASCE are comprised of leading experts in the fields of structural analysis and design, fire engineering, blast effects, and building materials. On October 1st, the WTC study became a joint effort between ASCE and the Federal Emergency Management Agency (FEMA), a partnership, which continues to this day.

The partnership with FEMA has proven to be extremely beneficial to the overall success and progress of the WTC team. In addition to providing funds, FEMA has provided logistical assistance, organizational and operational guidance, assistance in obtaining and organizing the needed data, and will provide the resources to publish the report. Utilizing the FEMA standard operation procedure for post-disaster engineering studies, managed through a contract with the architecture and engineering firm, Greenhorne & O'Mara, Inc., FEMA helped organize and coordinate the on-site operation of the BPS Team as they performed their initial data-collection efforts in New York City.

The WTC team is headed by W. Gene Corley, Ph.D., P.E., a preeminent expert on building collapse investigations and building codes. A full list of team members and an indication of their areas of expertise is attached. Dr. Corley, whose biography is attached, was the team leader and principal author of the ASCE/FEMA Murrah Federal Office Building Study Report in 1995.

The Pentagon team is headed by Paul Mlakar, Ph.D., P.E., of the U.S. Army Corp of Engineers Waterways Experiment Station in Vicksburg, Mississippi. Dr. Mlakar is a preeminent expert in blast engineering and was also a member of the ASCE/FEMA team, which examined the Murrah Federal Office Building.

In addition to assembling the teams of experts, SEI/ASCE has also organized a coalition of professional organizations to participate and support the work. These partnering organizations include: the Society of Fire Protection Engineers (SFPE), which provided recommendations of team members; the National Fire Protection Association (NFPA), which provided counsel on the fire engineering aspects of the study; and the Structural Engineers Association of New York (SEAoNY), which provided on-going assistance in the examination of the debris. It should be noted that SEAoNY, on its own initiative, was instrumental in providing assistance to the rescue and recovery operations immediately after the attacks. Additional members of the coalition are the American Institute of Steel Construction, Inc. (AISC), the American Concrete Institute (ACI), the Council of American Structural Engineers (CASE), the Council on Tall Buildings and Urban Habitat (CTBUH), the International Code Council (ICC), the Masonry Society (TMS) and the National Council of Structural Engineering Associations (NCSEA).

To increase our knowledge and understanding of the performance of the structures, the study is focusing on the response of the buildings, including fire behavior, structural design, fireproofing characteristics, and damage resulting from the aircraft impacts. As a result of this study, the structural and fire protection engineers comprising the team hope to provide an accurate description of the events and a preliminary assessment of the behavior of the affected buildings.

Data Collection

Simultaneous with the efforts to assemble the team and organize the supporting coalition, work began to collect data and information pertinent to the study. A significant part of this data collection phase was holding a meeting of the team in New York City to examine the wreckage and the surrounding buildings impacted by the collapse. On September 29th, the City of New York granted the team access to the World Trade Center site and from October 7th to the 12th, the entire team was on site. The team was provided with unrestricted access to all areas of the site except for areas where their presence might have impeded the on-going rescue and recovery efforts and areas which were determined to be extremely hazardous. To aid the team in this intense 6-day effort, FEMA made its Regional Operation Center (less that 8 blocks form the WTC site) available for use by the team on a 24–7 basis.

During this time period, team members also examined structural debris at the Fresh Kills Landfill on Staten Island and at the two recycling yards in New Jersey. Samples of structural steel were obtained and have since been subjected to laboratory analyses. Under the guidance of selected team members, numerous professional engineers who are members of SEAoNY are continuing this work on the team's behalf and have been visiting recycling yards and landfills regularly since the beginning of November. Additional samples of the structural steel have been obtained and are presently being stored at the National Institute of Standards and Technology in Gaithersburg, Maryland for use in future studies.

Unlike other structural collapses, there is an unprecedented volume of photographic and video evidence available for the team to review, including more than 120 hours of network and private video footage. Individual team members have viewed every foot of this videotape and provided information on the available data to the team at large.

Beyond the information and data pertaining to the events on September 11th, there is also a need to establish, as accurately as possible, the physical attributes of the towers and surrounding buildings prior to the impact of the airplanes. Doing this is a monumental task. The construction of the towers was documented by literally thousands of engineering drawings. In addition, there were numerous changes to the towers over their life. This effort is also being conducted for WTC 7, which is of considerable interest to the team. These data, together with the data previously described will be used to construct detailed computer models of the structures.

Impediments Encountered by the Building Performance Study Teams

In the 10 years in which ASCE has been conducting studies of disasters we have learned that our teams will always encounter impediments. It is therefore not surprising that the study team has encountered some difficulties in their data collection activities. However, we have also learned that with time and persistence these difficulties are either overcome or an alternate approach is found to enable the team to satisfactorily complete their study as described below.

When studying damaged structures it is important to understand the physical nature of the original structure as soon as possible. Commonly this is accomplished by obtaining and studying the engineering plans of the structures. Because the team did not have the engineering plans of the affected structures during the site visit in early October, arrangements were made to have several of the principal designers make presentations to the team. These briefings enabled the team to conduct their site visit more efficiently and to better understand the structure of the affected buildings. The delay in the receipt of the plans hindered the team's ability to confirm their understanding of the buildings. Through the efforts of FEMA and others, the team received the engineering plans for the WTC Towers on January 8, 2002, and work is proceeding.

As noted previously, there is an enormous volume of video and photographic documentation of the events of September 11th. This type of evidence can often yield significant insights into the failure mechanisms but it is imperative that the highest quality video footage be used. The team did experience some difficulty in obtaining video footage from the various television networks.

Obtaining access to the site of a disaster is always difficult and clearly the search and rescue efforts and any criminal investigation must take first priority. However, in all studies of this nature, gaining access to the site as soon as possible is important in order to observe and document the debris and site conditions. For the future, it may be useful to consider some protocol or process whereby selected individuals from the BPST would be allowed on site in the initial days after a catastrophic event to gather critical data.

There has been some concern expressed by others that the work of the team has been hampered because debris was removed from the site and has subsequently been processed for recycling. This is not the case. The team has had full access to the scrap yards and to the site and has been able to obtain numerous samples. At this point there is no indication that having access to each piece of steel from the World Trade Center would make a significant difference to understanding the performance of the structures.

Resources are always an issue with building performance studies, particularly for one whose magnitude and scale is unprecedented. The total amount of resources being dedicated to support the team's activities is approximately $1 million, which has allowed the team to do the initial reconnaissance of the site and the building materials, begin the process of hypothesis setting, and conduct some limited testing. This raises the question of what amount of money would be sufficient. It is our opinion that $40 million would be a sufficient amount to fully fund a comprehensive study of an event of this magnitude and complexity.

A Protocol for Future Building Performance Study Teams

The Building Performance Assessment Team program in place within the Federal Emergency Management Agency (FEMA) has a long and distinguished history of providing excellent information to the engineering profession. The BPAT program has a detailed protocol in place which has been continually refined and improved upon throughout its use.

Similarly, ASCE's Disaster Response Procedure has been successfully used by ASCE to conduct important studies of significant disasters. ASCE's procedure also has been refined and improved upon through its history.

The history of both of these programs however has been predominantly with natural disasters such as hurricanes, earthquakes or floods. While it is certainly our sincere hope that the anti-terrorist efforts of our government will prove successful, it may be useful to review the existing protocols from the perspective of their application to major, unprecedented events such as the terrorist attack on the World Trade Center. This could address some of the impediments that were discussed above.

A Case Study for Improved Building Practices?

As many in the United States and the world examine the future of tall buildings it is important to look at how well these buildings performed under extreme circumstances. It must be remembered that large commercial aircraft hit the World Trade Center Towers, yet both withstood the initial impact. Additionally, as has been widely reported, almost all of the individuals in the buildings below the impact zone were able to get out of the buildings to safety. Efforts such as that being conducted by the Building Performance Study teams and studies emanating from this initial study will seek to extend the performance of structures to allow occupants ample time to reach safety.

Because there is no limit to the destructive forces which terrorists can bring to bear against our built infrastructure it is impossible to design a building to withstand such an attack. The multi-faceted approach presently being pursued, that being to prevent the attack initially and pursue rational, scientifically based methods to improve structural performance, is both sound and prudent.

Future Research Needs for Civil Engineering

As has occurred throughout the world, the events of September 11th have created new challenges for the civil and structural engineering communities. Solving the problems presented by these challenges will be neither easy nor quick, and will require the collective efforts from a broad range of engineering and scientific disciplines.

While there will be a number of specific issues and recommendations in the reports being issued by the ASCE/FEMA WTC study team and the ASCE Pentagon study team later this spring, there are several high priority needs from the structural engineering community to which I would like to draw your attention:

> *Progressive Collapse:* The likelihood of a building or structure collapsing progressively is dependent upon two inter-related through separate behaviors: the event or load to which the structure is subjected and the strength or redundancy of the structure. At present, there is no rational technical basis to specify the initiating event or conversely to evaluate the effectiveness of alternative mitigation strategies, either alone or in combination. While virtually all structures contain some degree of redundancy, we must now live, build and function in a world where the performance demands placed on our built infrastructure

have been altered, thereby necessitating the development of engineering-based tools to guide our profession in the future.

Fire-Structure Interaction: While events such as those of September 11th are rare, and through the efforts of the President and Congress will be even less likely in the future, normal fires in buildings and other structures are not rare events. To continue to improve the performance of structures in a fire environment will require the development of new tools and design methods through the collaboration of the fire engineering and structural engineering communities for application to both new and existing buildings. This work should include tools by which to address fire as a structural design load, understanding the behavior of structural connections under fire conditions, and a coupling between fire dynamics and structural response.

We believe that each of these needs are crucial to advancing the health, safety, and welfare of the citizens of our nation. Each of these priorities are also highly complex and will require a substantial partnership between public agencies and private organizations to accomplish this work.

In the private sector, ASCE has begun this work through the establishment of a multidisciplinary coalition of engineering organizations. This coalition, led by the Structural Engineering Institute of ASCE, includes the Society of Fire Protection Engineers, the National Fire Protection Association, the Structural Engineers Association of New York, and the International Code Council. Taken in combination, this coalition represents over 250,000 architects, engineers and scientists who stand ready to bring their talents and expertise to meeting the needs of our nation.

In the public sector, the National Institute of Standards and Technology's (NIST) Building and Fire Research Laboratory (BFRL), as the only federal laboratory dedicated to both building and fire research, BFRL can play a key role in assessing and addressing the vulnerability of the nation's buildings and physical infrastructure. The public-private response program that has been established with significant NIST leadership encompasses the critical needs identified above. We urge you to provide the support and resources sought by NIST so that together we can continue to provide the reliability and performance which our country expects from our physical infrastructure.

Conclusion

Thank you for the opportunity to express ASCE's views. We offer you and all of the agencies involved in the recovery efforts ASCE's full resources to manage the nation's critical infrastructure needs. We are ready to help in any way possible, and I am eager to hear from you regarding ways that ASCE's CIRI can support you as you examine our infrastructure needs in the coming months.

ASCE/FEMA World Trade Center Building Performance Assessment Study Team Members

W. Gene Corley, Ph.D., P.E., S.E. (Team Lead)
Senior Vice President
Construction Technologies Labor
Skokie, Illinois
Expert in building collapse investigations; principal investigator, Murrah Federal Office Building Study

William Baker, P.E., S.E.
Partner, Skidmore Owings & Merrill LLP
Chicago, Illinois
Expert in tall-building design

Jonathan Barnett, Ph.D.
Professor, Center for Fire Safety Studies
Worcester Polytechnic Institute
Worcester, Massachusetts
Expert in building fire safety design and fire computer modeling

David T. Biggs, P.E.
Ryan-Biggs Associates
Troy, New York
Expert in facades

Bill Coulbourne, P.E., S.E.
Principal, URS Corporation
Gaithersburg, Maryland
Expert in BPAT Studies

Edward M. DePaola, P.E.
Partner, Severud Associates
Consulting Engineers
New York, New York
Expert in structural engineering

Robert F. Duval
Senior Fire Investigator
National Fire Protection Association
Expert in fire investigations

John W. Fisher, P.E.
The Joseph T. Stuart Professor of Civil & Environmental Engineering
Lehigh University
Bethlehem, Pennsylvania
Expert in metallurgy and connections

Richard G. Gewain
Senior Engineer, Hughes Associates, Inc.
Baltimore, Maryland
Expert in fire engineering

Ramon Gilsanz, P.E., S.E.
Parner, Gilsanz Murray Steficek, LLP
New York City
Expert in structural engineering

John L. Gross, Ph.D., P.E.
Leader, Structural Systems and Design Group
Building and Fire Research Laboratory
National Institute of Standards and Technology
Gaithersburg, Maryland
Expert in steel design and fire-structure interaction

Ronald Hamburger, P.E., S.E.
Senior Vice President,
EQE Structural
Engineers Division
ABS Consulting
Belmont, California
Expert in structural analysis and design

Nestor Iwankiw
Vice President, Engineering and Research
American Institute for Steel Construction
Chicago, Illinois
Expert in steel design

Venkatesh Kodur, Ph.D., P.E.
Institute for Research in Construction
National Research Council of Canada
Ottawa, Ontario
Expert in fire resistance design and fire effects on materials

Eric Letvin
Department Head, Hazards Engineering Group
Greenhorne & O'Mara
Greenbelt, Maryland
Project Manager

Jon Magnusson, P.E.
Chairman of the Board, Chief Executive Officer
Skilling Ward Magnusson Barkshire, Inc.
Seattle, Washington
Expert in structural analysis and high-rise design

Christopher E. Marrion, P.E.
Fire Strategist, Arup Fire
New York, New York
Expert in fire engineering

Therese P. McAllister, Ph.D., P.E.
Senior Structural Engineer
Greenhorne & O'Mara
Greenbelt, Maryland
Team Coordinator

James Milke, Ph.D., P.E.
Associate Professor & Associate Chair, Department of Fire Protection Engineering
University of Maryland
College Park, Maryland
Expert in fire resistance analysis

Harold E. "Bud" Nelson
Consultant
Annandale, Virginia
Expert in fire engineering

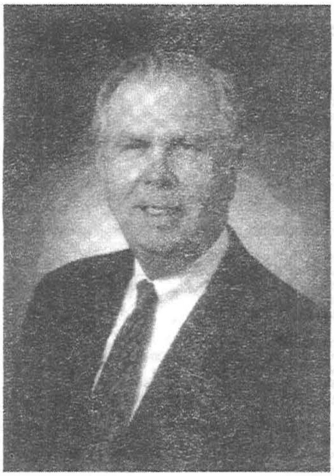
James A. Rossberg, P.E.
Director, Structural Engineering Institute
ASCE
Reston, Virginia
ASCE Staff Lead

Saw-Teen See, P.E.
Managing Partner
Leslie E. Robertson Associates
New York, New York
Expert in structural analysis and high-rise design

Robert Smilowitz, Ph.D., P.E.
Principal, Weidlinger Associates
New York City
Expert in blast effects

Bruce Swiren
Hurricane Program Manager, Region II
Federal Emergency Management Agency
New York, New York
FEMA Region II Contact

Paul Tertell, P.E.
Program Manager, Building Performance Assessment Team
Federal Emergency Management Agency
Washington, D.C.
FEMA BPAT Project Officer



***Educational Background* •**
University of Illinois
B.S. Civil Engineering, 1958
M.S. Structural Engineering, 1960
Ph.D. Structural Engineering, 1961

***Registration* •**
Licensed Structural Engineer - Illinois
Licensed Professional Engineer - Illinois
Registered Civil Engineer - California, Hawaii
Registered Professional Engineer - Alabama, Florida, Kansas, Louisiana, Michigan, Mississippi, Missouri, Pennsylvania, South Dakota, Tennessee, Texas, Utah, Virginia, Washington
Chartered Engineer, FI Struct E, UK

W. Gene Corley

Senior Vice President
gcorley @ c-t-l.com

CTL Experience • Dr. Corley has served as CTL Vice President since 1987. In this position, he serves as CTL's managing agent for professional and structural engineering and leads structural evaluation projects related to industrial, transportation and parking facilities, bridges and buildings. He also is active in projects related to earthquake engineering. His wide range of experience includes evaluation of earthquake and blast damaged buildings and bridges; investigation of distress in prestressed concrete structures; repair of parking garages damaged by corrosion; evaluation and repair of high rise buildings, stadiums, silos and bridges; design and construction of repairs for prestressed and conventionally-reinforced, precast and cast-in-place concrete and structural steel facilities. In 1995, Dr. Corley was selected by ASCE to lead a Building Performance Assessment Team investigating the bombing of the Murrah Federal Building in Oklahoma City.

Prior Experience • After receiving his B.S. degree, Dr. Corley worked for the Shelby County, Illinois highway department where he designed highways and bridges. He then returned to the University of Illinois as a research assistant and National Science Foundation teaching fellow while pursuing his graduate studies.

Upon completion of his Ph.D., he served as a commissioned officer in the U.S. Army from 1961 until 1964. During this period, Dr. Corley was a research and development coordinator with the U.S. Army Corps of Engineers at Fort Belvoir, Virginia. His duties included bridge design, acceptance testing of mobile floating assault bridge equipment, design of tank launched bridges and fatigue testing of bridges fabricated from high strength steel, aircraft aluminum and titanium alloys.

In 1964, Dr. Corley began work as a development engineer with the Portland Cement Association. While serving in successively more responsible positions, he was directly involved in the development of improved design procedures for structural concrete, concrete pavement, railroads and structures subjected to fire loads. In addition, he served on an earthquake damage investigation team, carried out investigations of damaged or deteriorated structures and developed repair procedures for numerous buildings and bridges.

Publications and Professional Activities •
W. Gene Corley has authored more than 150 technical papers and books. He frequently lectures to technical and non-technical groups on the subjects of prevention of failures, effects of earthquakes and design and repair of structures. He regularly presents

training courses on reinforced concrete design and teaches the seismic design portion of a refresher course to candidates for the Illinois Structural Engineering License examination.

Dr. Corley chaired ACI Committee 318 for six years as the committee developed the 1995 Building Code Requirements for Structural Concrete. He also serves on several other national and international committees that prepare recommendations for structural design and for design of earthquake resistant buildings and bridges. His professional activities resulted in his receiving 11 national awards including the Best Structural Publication Award from NCSEA, Outstanding Paper from the ASCE Journal of Performance of Constructed Facilities, the Wason Award for research from ACI, the T.Y. Lin Award from ASCE and the Martin Korn Award for PCI. He also has received several regional awards, including the UIUC Civil Engineering Alumni Association's Distinguished Alumnus Award, the SEAOI Service Award, Illinois ASCE Structural Division's Lifetime Achievement Award, the Henry Crown Award, and the SEAOI John Parmer Award.

Dr. Corley serves or has served in leadership roles for numerous professional organizations, both national and international, including the following:

American Society of Civil Engineers (Fellow)
National Society of Professional Engineers (Member)
National Council of Structural Engineers Associations (Founding Member, Board of Direction, Former President)
American Concrete Institute (Fellow) Former Chairman, Committee on Standard Building Code
American Railway Engineering Association (Member)
Building Seismic Safety Council (Former Vice-Chairman and Founding Member, Board of Direction)
Chicago Committee on High Rise Buildings (Member and Former Chairman)
Earthquake Engineering Research Institute (Member and Former President, Great Lakes Chapter)
Institution of Structural Engineers, UK (Fellow)
International Association for Bridge and Structural Engineering (Member)
National Academy of Engineering (Member)
National Association of Railroad Safety Consultants and Investigators (Member)
NACE International (Member)
Prestressed Concrete Institute (Member)
RILEM (Member)
Post Tensioning Institute (Member)
Transportation Research Board (Member)
Structural Engineers Association of Illinois (Member, Former President)
Governor's Earthquake Preparedness Task Force (Illinois)

ASCE

American Society of Civil Engineers

Washington Office
1015 15th Street, N.W., Suite 600
Washington, D.C. 20005-2605
(202) 789-2200
Fax: (202) 289-6797
Web: http://www.asce.org

March 18, 2002

The Honorable Sherwood Boehlert
Chairman
Committee on Science
U.S. House of Representatives
2320 Rayburn Building
Washington, D.C. 20515-6307

Dear Mr. Chairman:

On behalf of the American Society of Civil Engineers, a witness before the Subcommittee, we declare, pursuant to House Rule IX, clause 2(g)(4), that Gene Corley, Senior Vice President at CTL Engineering in Chicago, IL, and CTL have received the following federal grants in the past three years: U.S. Department of Transportation $975; Department of the Navy $9,900;and U.S. Department of Justice $95,136.

Additionally, the American Society of Civil Engineers has received the following grants in the last three years, please see attached sheet.

Sincerely yours,

Brian Pallasch
Director, Government Relations

American Society of Civil Engineers

Federal Grants
FY 2000 - 2002

Agency	Amount	Program
FY00		
1. FEMA	$200K	American Lifelines Alliance Project
	$132K	Code Monitoring
2. NSF	$25K	Sponsorship of Workshop on Women in Engineering
	$39K	Australian Conference Support
	$50K	EXCEED Teaching Workshop
3. DOI/BUREC	$10K	Watershed Management Conference
4. HUD	$24K	IBHS workshop support
5. USGS	$25K	IBHS workshop support
6. EPA	$460K	Stormwater BMPs
FY01		
1. FEMA		$200K
		American Lifelines Alliance Project
	$108K	Code Monitoring
2. EPA	$152K	SSOs Solutions
	$150K	BMPs
3. NSF	$50K	World Congress
FY02		
1. FEMA	$500K	American Lifelines Alliance Project
	$248K	WTC Assessment
	$650K	Manuals for Seismic Installation of MEP Equipment
	$111K	Code Monitoring
2. EPA	$150K	SSOs
	$158K	BMPs

Chairman BOEHLERT. Thank you very much, Dr. Corley. Dr. Corbett.

STATEMENT OF PROFESSOR GLENN P. CORBETT, ASSISTANT PROFESSOR OF FIRE SCIENCE AT JOHN JAY COLLEGE, NEW YORK CITY

Mr. CORBETT. Yes. Good afternoon, Chairman Boehlert, and, members of the House Committee on Science. I want to thank you for inviting me to speak on the topic of the World Trade Center disaster investigation. This is an issue of significant national importance, and I speak for many who understand this importance.

I would like to discuss three issues with you today—an analysis of the current building performance assessment study of the World Trade Center collapse, a proposal for an enhanced national disaster investigation response protocol for future disasters, and a recommendation for a commission on the World Trade Center disaster.

In the wake of the loss of the World Trade Center, many questions began to arise as to the cause of the collapse of the Twin Towers. What were the specific causal factors of the collapse, and what was the exact sequence of events that led to the collapse? These are important questions that impact national security. We are a Nation at risk. There are many high-rise buildings and structures across the country and many more on the way and we need to learn from the events of 9/11 and apply these lessons.

As engineers, architects, builders, as firefighters, and as citizens who occupy high-rises, and as those who are in a position to protect those citizens, there are critical questions regarding this collapse, and they need answering. And we need to extract all of the lessons for the—for future generations who will live and work in high-rise buildings.

The building performance assessment currently being conducted of the collapse is just that—an assessment, not an investigation, in my opinion. While the Building Performance Assessment Team is composed of an elite group of engineers and scientists, the standard procedures used by the BPAT team have proven to be inadequate. Handling the collapse study as an assessment, rather than as an investigation, has allowed valuable evidence in the form of the towers' structural steel to be destroyed. It is the steel that holds the primary key to understanding the chronology of the events resulting in the collapse.

Without an official investigative presence, the FEMA Sanction Assessment Team did not have the authority to ensure that all the structural steel was thoroughly examined and the crucial steel from the points of impact were saved for examination. It is my understanding that only a handful of pieces of the steel from the points of impact have been secured to date. In addition, the BPAT team studying the collapse has apparently been hampered in accessing building construction documents. These problems will have an impact on the BPAT report that is due to be released in April. The lack of significant amounts of steel for examination will make it difficult, if not impossible, to make a definitive statement as to the cause and chronology of the collapse.

The collapse of the World Trade Center disaster—the World Trade Center towers was the largest structural collapse in world history. A disaster of such epic proportions demands that we fully resource a comprehensive, detailed investigation. Instead, we are staffing the BPAT with part-time engineers and scientists on a shoestring budget.

The current World Trade Center disaster inquiry has exposed a gaping hole in the way that we investigate disasters. We don't have a comprehensive plan for disaster investigations, except for plane crashes, and we don't apply the necessary resources for a complete and thorough investigation. And we need to have an enhanced disaster investigation response protocol that provides for a systematic, multidisciplinary, and scientifically rigorous approach. We need to bring in the experts in an organized and rapid manner to extract all of the lessons from the disaster. Finally, we need to make sure that the lessons are actually applied.

I would recommend that the task force be impaneled to develop an enhanced disaster investigation protocol. Given FEMA's role in disaster response and their critical disaster mitigation responsibilities, I would recommend that this task force be initiated within their organization.

With regard to the World Trade Center disaster, there are several other additional areas that need to be investigated and studied. Specifically, there are five additional focus areas that are of concern—an analysis of the building design itself, the fire fighting operations, the building evacuations, the search and rescue operations, and the relationship between the disaster and our building and fire codes.

In order to gather all the lessons, we must analyze the disaster as a whole. Studying them as individual items eliminates the critical process of information-sharing and understanding the interrelationships between these different focus areas. We need to bring all six of these focus areas together as a collective group under one roof, so to speak. Studying the disaster as a whole will also ensure coordination, avoid duplication, and verify that all areas of concern are being covered. I would recommend that a commission on the World Trade Center disaster be immediately organized to initiate a comprehensive investigation and to coordinate the existing public and private research projects that are already underway.

For example, an ad hoc committee entitled, "The World Trade Center Evacuation Study Initiative," has been meeting for several months to study the issues of the building evacuations. Study groups like these need to be brought together. A variety of important lessons will come from the World Trade Center disaster that will apply to our current national building codes.

For example, our current requirements in high-rise structures treat a 15-story building the same as we treat a 100-story building. In fact, from a fire-fighting perspective, a 15-story building is completely different than a 100-story building, as we well know.

Another example is that the test that we utilize to establish the fire resistance of beams and columns—steel columns. The test was first developed in the 1920's and, yet, we are still using the same test with the same 1920's fires in the year 2002. We need to address and correct these kinds of deficiencies.

We can learn many lessons from the disaster at the World Trade Center. In fact, we must learn these lessons. The lessons will form better building codes, improved building design methodologies, improved emergency procedures, and enhanced protection against terrorist attacks. We must assure that these lessons are actually applied, increasing the level of safety and security for all of our citizens.

I thank you, Chairman Boehlert, and the honorable members of the Committee on Science for giving me this important opportunity to share my thoughts with you. I would be happy to answer any questions that you may have and we would ask that——

[The prepared statement of Mr. Corbett follows:]

PREPARED STATEMENT OF GLENN P. CORBETT

Good afternoon Chairman Boehlert and Members of the House Committee on Science. I want to thank you for inviting me to speak on the topic of the World Trade Center disaster investigation. This is an issue of national importance, and I speak for many who understand that importance.

I would like to discuss three issues with you today: an analysis of the current building performance assessment study of the World Trade Center collapse, a proposal for a national disaster investigation response protocol for future disasters, and a recommendation for a *Commission on the World Trade Center Disaster.*

In the wake of the loss of the World Trade Center, many questions began to arise as to the cause of the collapse of the twin towers. We know, of course, that the towers collapsed catastrophically in a very short time. We know that there is no precedent for this event. And we in the fire protection engineering community know that building failures result directly from very specific causal factors and structural behavioral characteristics that, in the case of the WTC, have yet to be determined.

What role did the planes play in destroying the structural integrity of the towers? What was the impact of the jet fuel fires upon the steel trusses and columns? How long did the jet fuel fires burn? What were the specific causal factors of collapse and what was the exact sequence of events that led to the collapse?

These are important questions that impact national security. We are a nation at risk. There are many high-rise structures in the United States—and more on the way—that demand that we learn from the disaster on 9–11 and apply the lessons learned.

As engineers, as architects, as builders, as firefighters, as citizens who occupy high-rises, and as those who are in a position to protect those citizens, there are critical questions regarding this collapse that need answering. We must extract the lessons for future generations who will live and work in high-rise structures.

The building performance assessment currently being conducted of the World Trade Center collapse is just that: an assessment, not an investigation. While the Building Performance Assessment Team (BPAT) is composed of an elite group of engineers and scientists, the standard procedures used by the BPAT have proven to be inadequate. Handling the collapse study as an assessment has allowed valuable evidence—the steel building components—to be destroyed. The steel holds the primary key to understanding the chronology of events and causal factors resulting in the collapse.

Without an *investigative* presence, the FEMA-sanctioned assessment team did not have the authority—nor the organizational wherewithal—to ensure that *all* of the structural steel was thoroughly examined and the crucial steel from the points of impact saved for examination. Only a handful of pieces of steel from the points of impact have been secured to date. In addition, the BPAT studying the collapse has apparently been hampered in accessing building construction documents.

These hindrances will have an impact on the BPAT report, due to be released in April. The lack of significant amounts of steel for examination will make it difficult, if not impossible, to make a definitive statement as to the *specific* cause and chronology of the collapse.

The collapse of the World Trade Center towers were the largest structural collapses in world history. A disaster of such epic proportions demands that we fully resource a comprehensive, detailed investigation. Instead, we are staffing the BPAT with part-time engineers and scientists on a shoestring budget.

The current World Trade Center disaster inquiry has exposed a gaping hole in the way that we investigate disasters. We don't have a *comprehensive* plan for disaster investigations (other than plane crashes) and we don't apply the necessary resources for complete and thorough investigations of disasters.

We must have a comprehensive plan in place to handle such large-scale investigations. We need to have a greatly enhanced national disaster investigation response protocol, providing for a systematic approach. We must bring in the experts in a rapid, organized manner to extract *all* of the lessons from a disaster. Finally, and most importantly, we need to ensure that the lessons are actually applied.

I recommend that a task force be impaneled to develop such a protocol. In my opinion, FEMA would be the best organization to organize the task force, given their role in disaster response and their critical disaster mitigation responsibilities. *[Witness would like to submit, for the record, a document entitled Appendix A "PROPOSAL FOR AN ENHANCED DISASTER INVESTIGATION PROTOCOL."]*

The collapses of the World Trade Center structures are not the only areas of concern. There are five other very important areas of study concerning the World Trade Center disaster need to be explored. In addition to the collapse study, we should be analyzing the building designs themselves, the firefighting procedures, the building evacuations, the search and rescue operations, and the impact on building and fire codes.

These six primary focus areas would form the basis of a complete World Trade Center study. Since these focus areas are multidisciplinary, it is critical that the experts in each of these areas be permitted to come together under one roof, so to speak. This will ensure coordination, avoid duplication, verify that all areas of concern are covered, and ensure that the essential process of information sharing takes place.

The World Trade Center disaster must be analyzed as a total event, using an integrated, scientifically rigorous approach. Studying the issues individually minimizes the effect on the whole. There are interrelationships among these areas that must be combined and the lessons applied for future generations.

I recommend that a *World Trade Center Disaster Commission* be immediately organized to initiate a comprehensive investigation and to coordinate the existing public and private World Trade Center research projects currently underway. For example, an ad hoc committee entitled the

World Trade Center Evacuation Study Initiative (composed of life safety experts from many different organizations) has been meeting for several months to study the issues of the World Trade Center building evacuations. It is important that this group and other World Trade Center research projects come together to allow for a coordinated approach to studying this disaster.

The *Commission* should be given the appropriate authority and staff to ensure that a viable investigation plan is created and implemented, with the ultimate goal of producing a comprehensive report that details the findings of the investigation, the "lessons learned," and, finally, the "needs for further research."

Some of the lessons that will emerge in the *Commission* report will apply directly to our building codes and the way that we build new structures. Of particular importance are the regulations covering fire protection of high-rise buildings. *[Witness would like to submit, for the record, a document entitled Appendix B, "PROPOSAL FOR A WORLD TRADE CENTER DISASTER COMMISSION."]*

Our current high-rise code requirements do not address the real world issues encountered when fighting fires in high-rise buildings. For example, our model building codes treat a 15-story building exactly the same as a 100-story building in terms of fire protection—we apply the same level of structural fire resistance, the same fire protection systems, the same everything. We place heavy reliance on automatic sprinkler systems, with little redundancy in terms of structural fire resistance to ensure that the building will stay up long enough to allow for firefighters to reach the fire area, rescue trapped inhabitants, and generally deal with the situation. Automatic sprinklers are the best protection against fire, but we need to have a backup when we are 1,000 feet high in a building on fire. We need a proper balance of passive and active protection in larger high-rise structures.

An example of the crucial need for research is found when we analyze the current test used to establish the fire resistance various structural members used in buildings. This test, commonly known as A.S.T.M. E–119, was developed to provide assurance that the fire protection coating/encasement provided for beams and columns would allow them to be subjected to high temperatures and not collapse. This test, however, dates back to the 1920's and is based upon the temperatures recorded when a set of buildings were burned back then for study purposes. Today, we basically still use the same test with the same "fire" temperature and exposure conditions developed over 75 years ago. I would argue that the fires of the 1920's are different than those of today, and that this nationally accepted test needs to be thoroughly reexamined in light of what happened on 9–11.

We can learn many lessons from the disaster at the World Trade Center. In fact, we *must* learn these lessons. The lessons may take the form of better building code regulations, enhanced building design methodologies, improved emergency procedures, and enhanced protection against terrorist attacks. We must assure that these lessons are actually applied, thus improving the level of safety and security for American citizens.

I thank you, Congressman Boehlert and honorable Members of the Science Committee, for giving me the opportunity to share my thoughts with you. I would be happy to answer any questions that you may have.

Appendix A

PROPOSAL FOR AN ENHANCED DISASTER INVESTIGATION PROTOCOL

PREPARED BY PROFESSOR GLENN P. CORBETT

JOHN JAY COLLEGE OF CRIMINAL JUSTICE

Need for an Enhanced Protocol:

When a major disaster strikes in the United States, very important questions typically arise: What happened? Why were so many lives lost? How can we prevent this from happening in the future?

These questions need answers. If we are to protect ourselves and future generations, we must learn the lessons of the disaster and apply them.

For past disasters like the Oklahoma City bombing and the Northridge earthquake, a variety of research projects were undertaken. While these research projects produced very useful information, they were conducted independently, without the benefit of a central coordinating body to integrate all of the information. In addition, it has become apparent that some of the very critical lessons never found their way into general design practice—there is a disconnect between the private sector code-writing organizations and the lessons coming out of the research projects.

Since disasters are multidisciplinary, they require an integrated and comprehensive approach. The disaster must be investigated as a whole, following standard investigative procedures. A single standardized model can be developed for all disasters, with a specific set of "adaptable" procedures for each type of disaster.

Development of an Enhanced Disaster Investigation Protocol

Since FEMA has responsibilities for disaster response and disaster mitigation, it is suggested that the development of an enhanced disaster investigation protocol be initiated within FEMA. Other Federal agencies and private sector organizations with disaster responsibilities/interest would obviously need to participate in the development of the protocol. The National Transportation Safety Board's investigation procedures provide a very useful model for which to begin the development of an enhanced disaster investigation protocol.

"Organizational" Details of a Enhanced Disaster Investigation Protocol

Organizationally, an enhanced disaster investigation protocol:

- Utilizes an *investigative* "lessons learned" approach to analyzing disasters.
- Provides a detailed investigation "command structure" to establish which agency is in charge and the limits of its investigative authority.
- Details the responsibilities of each participating organization.
- Establishes the specific types of disasters that will be investigated and the necessary resources needed for each type of disaster.

"Functional" Details of an Enhanced Disaster Investigation Protocol

Functionally, an enhanced disaster investigation protocol:

- Incorporates a "rapid response" capability, allowing for the immediate deployment of a initial set of investigators to plan the investigation, secure evidence, and to begin the documentation process.
- Ensures the deployment of self-sufficient, disaster-specific "specialist teams" to the scene to conduct the detailed investigation work (similar to USAR organization).
- Ensure that periodic press releases are issued to inform the public of the investigation and its progress.

"Coordination" Details of an Enhanced Disaster Investigation Protocol

In order to assure coordination, an enhanced disaster investigation protocol:

- Ensures that liaisons are appointed to the local incident commander's command post, search and rescue teams (e.g., USAR), and criminal investigation organizations (e.g., FBI) to ensure coordination with their efforts.
- Ensures that the appropriate "specialist teams" are deployed and are working together efficiently.
- Ensures that additional "outside" research efforts are integrated into the investigation.
- Ensures that a regimented set of meetings with specialist team leaders and staff are held to review progress and to keep investigation on course.

"Final Report" Details of an Enhanced Disaster Investigation Protocol

In order to produce a comprehensive report, an enhanced disaster investigation protocol:

- Ensures that the specialist team leaders are assembled to provide oral presentations to other team leaders/staff and to provide written draft reports for inclusion in Final Report.
- Ensures that the staff support collates the team reports and configures them into a standardized, "single author" report format.
- Ensures that long-term research needs are identified and documented for inclusion in the Final Report.

"Applied Lessons" Details of an Enhanced Disaster Investigation Protocol

To ensure the application of the "lessons learned," an enhanced investigation protocol:

- Appoints code-writing organization representatives to investigative "specialist teams."
- Establishes a "formal agreement" with the private sector code-writing bodies that ensures every recommendation for a change in the codes will be formally reviewed by the code-writing body. Final disposition of "disaster" code change proposals (including rationale if code change is rejected) will be formally documented and issued back to the affected disaster investigation organizations.

Appendix B

PROPOSAL FOR A WORLD TRADE CENTER DISASTER COMMISSION

Prepared by Professor Glenn P. Corbett

John Jay College of Criminal Justice

Need for the Commission:

In the wake of the World Trade Center disaster, it has become readily apparent that many issues involving high-rise building construction, emergency evacuation procedures, firefighting operations, and other important concerns must be analyzed collectively in order to learn from the disaster and apply the lessons to the future. Many Americans live and work in high-rise buildings, so it is essential that we learn as much as possible about this disaster.

The establishment of a Commission will allow for the various public and private research efforts currently underway to come together "under one roof" and share information, a critical issue when studying a disaster as complex as the collapse of the World Trade Center towers. The multidisciplinary aspects of the World Trade Center necessitate that the disaster be investigated in that context, allowing for the identification of interrelationships between the areas of concern.

Commission Objectives:

- The Commission will direct an investigation and coordinate a comprehensive review of all aspects of the World Trade Center disaster. The Commission will take a "lessons learned" type of approach in its review and analysis of the disaster.
- The Commission will utilize the expertise of nationally recognized individuals in the fields of architecture, engineering, forensic investigation, construction

methods and materials, fire protection and life safety, human behavior, firefighting, search and rescue, terrorism, building/fire code development and emergency management.

- The Commission will prepare a set of detailed recommendations for the improvement of building designs, building materials, safety regulations and building codes, as well as emergency response procedures.
- The Commission could form the model for a portion of an enhanced disaster investigation protocol.

Establishment of the Commission:

Given the role of FEMA in disaster response and hazard mitigation, it is logical to have the Commission operate under the auspices of FEMA. FEMA would play the role of coordinator and provide staff and facility support (including the development of a final report).

The Commission should have a "core" of eight primary members, including a Chairman, a Vice Chairman, and designated leaders from each of the six focus areas identified below. All eight of the Commissioners would meet on a regular basis to share information, identify needs, and to direct the overall activities of the Commission.

Six Primary "Focus Areas" of Commission:

- *Building Design*
- *Building Collapse*
- *Firefighting Procedures*
- *Building Evacuation*
- *Search and Rescue Operations*
- *Building Codes and Regulations*

Examples of "Focus Area" Inquiries:

Building Design

- Identify general design concepts ("lightweight" construction, loads, etc.).
- List fire protection features in original design and improvements.
- Describe fire protection and life safety upgrades after 1993 attack.
- Establish means of egress design objectives.

Building Collapse

- *Create chronology of events leading to collapse.*
- Examination of physical evidence to identify failure mode(s) leading to collapse.
- Examination of physical evidence to assess material behavior.
- Model fire behavior (temperature, heat release rate, etc.), including contribution of jet fuel.
- Create fire and structural models to illustrate building conditions for duration of incident.

Firefighting Procedures

- Interview surviving firefighters, review radio transmissions, and analyze reports to create as complete a "picture" of firefighting response as possible.
- "Map" and analyze incident command structure.
- Establish the overall goals of incident command officers, including use of "standard" high-rise firefighting strategies.
- Enumerate tactical problems encountered by fire companies.
- Detail radio transmission problems at incident.

Building Evacuation

- Analyze building evacuation procedures, including directions given to occupants by building staff.
- Interview evacuees to collect their observations and experiences during evacuation.
- Model the evacuation including time of egress, points of constriction, crossovers delays, etc.
- Highlight the effects of improvements made after 1993 attack.

Search and Rescue Operations

- Detail coordinated effort between FDNY and USAR teams.
- Establish impact of "self-responders" on rescue operations.
- Analyze performance of "tools and technologies" used in search efforts (robots, "listening devices," cutting equipment, etc.).
- Detail efforts of maintaining "scene safety."

Building Codes and Regulations

- Establish national standards/codes in effect at time of construction.
- Identify the deficiencies of ASTM E–119 (a national test standard that establishes structural fire resistance of various fire resistive materials) when compared with the fire conditions experienced during the incident.
- Review the high-rise requirements found in current national building codes in context of this incident.
- Correlate accepted terrorism design strategies with this incident and develop design criteria for inclusion in building codes.

The Final Report of the Commission:

Upon completion of the investigation and research efforts, a final report should be issued. The report will tell the story of the disaster, highlight the lessons learned, identify additional research needs, and provide a set of specific recommendations. General examples of recommendations could include the following:

- Identification of building/fire code provisions that need to be added/updated/deleted.
- Procedural changes for fire service response to high-rise and terrorist incidents
- Changes in evacuation procedures and egress capacity criteria

GLENN P. CORBETT

136 Bergen Avenue
Waldwick, New Jersey 07463

Home:(201) 652- 9224
Work: (212) 237- 8092

SUMMARY: Extensive experience in different facets of fire protection including the fields of firefighting and fire prevention. In-depth knowledge of the development and trends of the American fire protection profession.

EXPERIENCE:

January 1995 to Present — **John Jay College of Criminal Justice,** New York, New York
Assistant Professor of Fire Science
Coordinator, Undergraduate Fire Science Programs
Director, Graduate Protection Management Program (Jan. 1995 – June 1997)

- Prepare and teach fire science courses at the undergraduate and graduate level
- Manage and coordinate course offerings in undergraduate fire science and fire and emergency services programs, including internet offerings
- Provide guidance to existing and prospective fire science students

Sept. 1994 to Dec. 1994 — Lecturer, Fire Science

April 1993 to April 1994 — **PennWell Publishing Company,** Saddle Brook, New Jersey
Technical Director, *Industrial Fire Safety* Magazine

- Provided and maintained technical editorial direction of an industrial fire protection and safety magazine, *Industrial Fire Safety*
- Reviewed all articles submitted for publication for accuracy and relevancy

August 1987 to April 1993 — **San Antonio Fire Department,** San Antonio, Texas
Administrator of Engineering Services

- Established Engineering Services Office, including procedures, policies, and the physical plant
- Directed and evaluated staff consisting of fire protection engineer and 3 plan reviewers
- Managed all plan reviews conducted by the department including (annually) 2000 building permits (1500 interior remodels, 500 new structures) and fire protection system plans (500 sprinkler, 350 fire alarm, and other types of systems)
- Coordinated fire prevention activities with other city departments such as Building Inspections and Planning
- Coordinated, prepared, and taught 250+ hour fire inspector training course
- Served/assisted various city committees such as a Development Task Force, Board of Appeals, and Blue Ribbon Fire Department Study
- Provided technical assistance to architects, engineers, developers, and contractors
- Assisted in the preparation of new fire code and amendments

March 1986 to August 1987 — **Austin Fire Department,** Austin, Texas
Fire Protection Engineer

- Reviewed fire protection system plans as well as water supply plans for code compliance
- Assisted uniformed personnel in the review of building permit plans
- Assisted in the preparation of code policy manual for development community
- Responded to multiple alarm fires to provide on-scene technical assistance

1985 — **A.B.C. Loss and Fire Prevention Corp.,** East Orange New Jersey
Loss Prevention Consultant

- Estimated and designed automatic sprinkler systems

- Monitored sprinkler system installations and evaluated existing systems

Concurrent *Fire Engineering* Magazine, **PennWell Publishing Company**, Fair Lawn, N.J.
Consulting Editor, August 1986 - September 1990
Editorial Advisory Board Member/Columnist, October 1990 - April 1993
Technical Editor/Columnist, April 1993 - Present
Fire Department Instructors Conference Planning Committee member (1997 - present)

1978 - 1986 & **Waldwick Volunteer Fire Department,** Waldwick, New Jersey
1994 - present Volunteer Firefighter (Through Dec. 1995)
Deputy Municipal Fire Coordinator (Jan. 1996 – Aug. 1997)
Second Lieutenant (Sept. 1997 – Dec. 1997)
First Lieutenant (Jan. 1998- Dec. 1998)
Second Captain (Jan. 1999 – Dec. 2001)
First Captain (Jan. 2002 – Present)

1979 - 1986 **Paterson Fire Department,** Paterson, New Jersey
Auxiliary Firefighter

EDUCATION: Worcester Polytechnic Institute, Worcester Massachusetts
1991 M. Eng., Fire Protection Engineering
Thesis: "Water Supply Evaluation for Firefighting"

John Jay College of Criminal Justice, New York, New York
1982 B.A., Fire Service Administration, Cum Laude
Dean's List, 1979 - 1982

MEMBER: Bergen County Fire Chief's Association
International Association of Fire Chiefs
International Society of Fire Service Instructors
National Fire Protection Association
New Jersey Society of Fire Service Instructors (currently serving as President)
Society of Fire Protection Engineers

COMMITTEE: "America Burning: Re-commissioned" Panel, appointed By Federal Emergency Management Agency (FEMA) Director James Lee Witt in August 1999

Fire Code Advisory Council, State of New Jersey

CERTIFICATION/LICENSE:
State of Texas:
Professional Engineer's License, # 80114
Inactive certification as Class "A" Fire Inspector and Basic Fire Instructor

State of New Jersey:
Firefighter I, # 109356
Fire Official, # A007103

February 22, 2002

The Honorable Sherwood Boehlert
Chairman, House Committee on Science
2320 Rayburn Office Building
Washington, DC 20515

Dear Congressman Boehlert:

Thank you for the invitation to testify before the U.S. House of Representatives Committee on Science, on February 26, 2002 for the hearing entitled, *Learning from 9/11: Understanding the Collapse of the World Trade Center.* In accordance with the Rules Governing Testimony, this letter serves as formal notice that I currently receive no federal funding in support of my research.

Thank you again for the opportunity to speak about this important issue.

Sincerely,

Prof. Glenn P. Corbett
John Jay College of Criminal Justice/CUNY

Chairman BOEHLERT. Thank you very much, Dr. Corbett. Dr. Astaneh.

STATEMENT OF DR. ABOLHASSAN ASTANEH-ASL, PROFESSOR, DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING, UNIVERSITY OF CALIFORNIA, BERKELEY

Dr. ASTANEH-ASL. With your permission—Mr. Chairman, with your permission, I would like to use the projection.

Chairman BOEHLERT. Can we have the lights dimmed, please, so we get a better—I thank you.

Dr. ASTANEH-ASL. Chairman Boehlert, members of the Committee, families of victims of the 9/11 terrorist attack, it is a great honor for me to testify here today.

My involvement in the collapse of the World Trade Center is to conduct reconnaissance of the collapsed and damaged World Trade Center buildings and to collect the structural engineering perishable data. The main objectives are to document failure modes, learn as much as possible from the collapse, collect material samples for future testing, and conduct a realistic failure analysis of the towers subjected to impact and ensuing fire in order to understand the causes of the collapse.

Our project was funded by the National Science Foundation as one of the eight Quick Response Research Awards a few days after the World Trade Center collapse. The other seven NSF grants are in the areas of fire engineering, social sciences, and response and recovery. I started my studies almost a week after the collapse and since then I have been able to investigate the structural elements of the World Trade Center and have collected data on failure modes, fire and impact damage, and have identified and saved sections of the structure that appeared to be impacted by the planes or have collapsed under an intense fire. I have also investigated the quality of construction.

Here are some samples of my work. I was not able to access Ground Zero, so I have done my investigation at the scrap yard, looking into important failure modes and collecting important items from the recycling plant.

We will, and still are, planning to build a realistic computer-based, structural model of the World Trade Center and towers, subject the model to a realistically simulated impact of the planes, and ensuing fire, and conduct a detailed stress analysis. However, since we have not been able to obtain drawings, even now, and other data, we are unable to proceed with our study.

I would like to show you the results of one such analysis of a generic building and what type of stress analysis we can do on the World Trade Center to understand its collapse.

Here is an example of a steel structure subjected to the impacts of a fully loaded, fueled 747 airplane. This is not artistic rendering or animation of the impact. This is the result of a mathematical analysis of stress.

Here is the plane approaching that building at 450 miles per hour. It impacts the building and damages the columns and enters. Close up here, you can see the damage to the structures while we have eliminated the plane and made it invisible. Here is the damaged area.

Here is the—to the right bottom is the plane and you are seeing the stresses developed in the plane and how a plane breaks. We have made the structure invisible. Notice the wings in this case clipping and dropping, but the plane breaks because the stresses are so high.

After plane enters the building, we can analyze the heat effects, in this case, the damaged structures subjected to the heat effects. And you can see the spread of temperature and weakening of steel and the final collapse. This is what we would like to do for the World Trade Center.

The impediments to our studies were not having access to Ground Zero and surrounding damaged buildings, not having enough time to inspect the World Trade Center steel before it was recycled, not having the drawings, videotapes, photographs, and other data on the building to conduct our analysis of the collapse.

On the subject of research needs, there are pressing needs for short-term, as well as long-term research, related to the World Trade Center collapse. In the short term, there is an urgent need for a comprehensive, in-depth, and scientific study of the collapse of the World Trade Center towers. Due to the unprecedented nature of the collapse and its complexity, a broad-based team of experts from academia, government agencies, and the private sector needs to be assembled to conduct such research-oriented investigations within the Federal entities such as NSF or NIST.

In the long term, there is a need for major and sustained funding to conduct basic and applied research on various aspects of terrorist attacks. Such research programs can be directed by the National Science Foundation, among others, which, over the last few decades, has directed so successfully the research and technology development in the area of earthquake hazard mitigation, among many others.

As for the fire research, NIST traditionally has been the leading research and development agency. Also, a significant amount of research has been done in academia. Such research activities supported by the Congress can result in the development of scientific methods and technologies that can be used to assure life safety in the event of future terrorist attacks, and minimize the impact of such attacks on the national security, economy, and quality of our lives.

I would like to take this opportunity and thank Chairman Boehlert and Members of the Committee on Science for inviting me to testify. I will be available to answer any questions that you might have.

[The prepared statement of Dr. Astaneh-Asl follows:]

PREPARED STATEMENT OF DR. ABOLHASSAN ASTANEH-ASL

It is a great honor for me to testify here today and address specific questions listed in your letter (in Italic below) regarding my involvement in the post disaster investigation of the World Trade Center.

- *What role did you play in the investigating the collapse of the WTC buildings and what do you expect to produce from your effort? How did you arrange NSF funding for your work, and how was that arranged so quickly?*

My involvement in the investigation of the collapse of the World Trade Center is to conduct a reconnaissance of the collapsed and damaged WTC buildings and to collect the perishable data. The main objectives of the reconnaissance are to learn as much as possible from the actual collapsed structures and to document the failure modes and performance of the members and connections as well as quality of the construction. The purpose of collecting the perishable data is to collect material samples, photographs, videotapes, drawings and data on design, construction and collapse. Using the information collected and by conducting the necessary analyses and research, we try to establish probable causes of the collapse and most likely scenario for such collapse.

Our project was funded by the Directorate of Engineering of the National Science Foundation as one of the eight Quick Response Research Awards in the aftermath of the WTC collapse. These projects focus on structural engineering (our project at UC–Berkeley), fire engineering, social aspects and response and recovery. More information on these projects can be found at www.nsf.gov. We prepared and submitted our proposal to the National Science Foundation three days after the 9/11 events and it was reviewed and funded by the end of the week. The credit for such a fast preparation, submittal, review and funding of these research projects should be given equally to the staff at the universities involved as well as the Program Directors and staff of the National Science Foundation. The use of "Fastlane" electronic submittal process of the NSF also expedited the process tremendously.

So far, I have made three trips to NYC and spent a total of about 25 days there conducting field investigation and collecting data. Upon arrival to NYC on September 19, and after visiting Ground Zero and paying my respects and prayers to the victims, I started my reconnaissance and collection of the perishable data. I have collected some data on design and construction of the WTC and have met and discussed the case with the structural engineers who have designed the WTC Buildings. Thanks to cooperation of the HSNE recycling plant, I have been able to study the steel from the WTC before recycling. I have identified and saved some components of the structures that appear to have been subjected to intense fire or impact of fast moving objects. Figures 1 through 4 show examples of inspected structures. These critical pieces are saved as perishable data and can be used in future research.

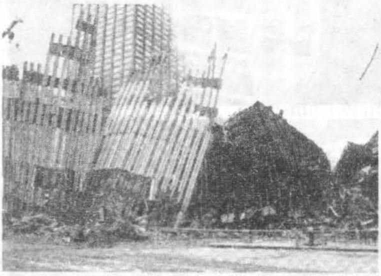


Photo by W. Farrington for A. Astaneh's NSF Report

Fig. 1. Collapsed exterior walls of WTC towers

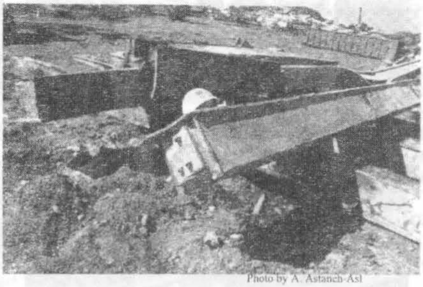


Photo by A. Astaneh-Asl

Fig. 2. A critical connection of exterior columns of WTC

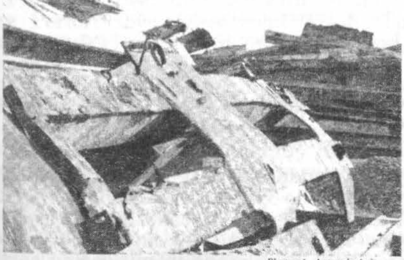


Photo: A. Astaneh-Asl

Fig. 3. Exterior columns of WTC towers probably buckled after being subjected to intense heat.

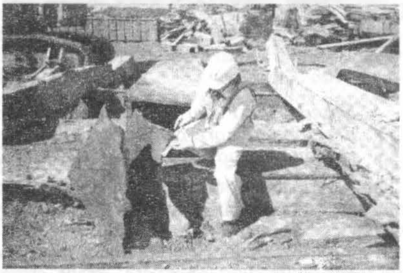


Photo: HNSE

Fig. 4. A. Astaneh inspecting an internal column of WTC which has been hit with a round object

- *Please describe the impediments that you encountered during the investigation of the collapse of the WTC buildings, such as the loss of material from the WTC site and any effects of such impediments on your work.*

I wish I had more time to inspect steel structure and save more pieces before the steel was recycled. However, given the fact that other teams such as NIST, SEAoNY and FEMA–BPAT have also done inspection and have collected the perishable data, it seems to me that collectively we may have been able to collect sufficient data. The main impediments to my work were and still are:

1. Not having a copy of the engineering drawings and design and construction documents.
2. Not having copies of the photographs and videotapes that various agencies might have taken during and immediately after the collapse.

Such data has already been made available to ASCE Building Performance Assessment Team. If those are also available to us, we will be able to proceed further with our research. Figure 5 shows an example of analysis of performance of generic steel high-rise structure subjected to the impact of a 747 jetliner and the ensuing fire. The example demonstrates the power of advanced technology developed in aerospace and mechanical engineering that can be brought to bear on this problem. We plan to use the drawings and the data and the software used in the example to build a computer based realistic model of the World Trade Center towers and analyze their response to simulated impact of the 767 planes that crashed into them on 9/11 and the ensuing fire.

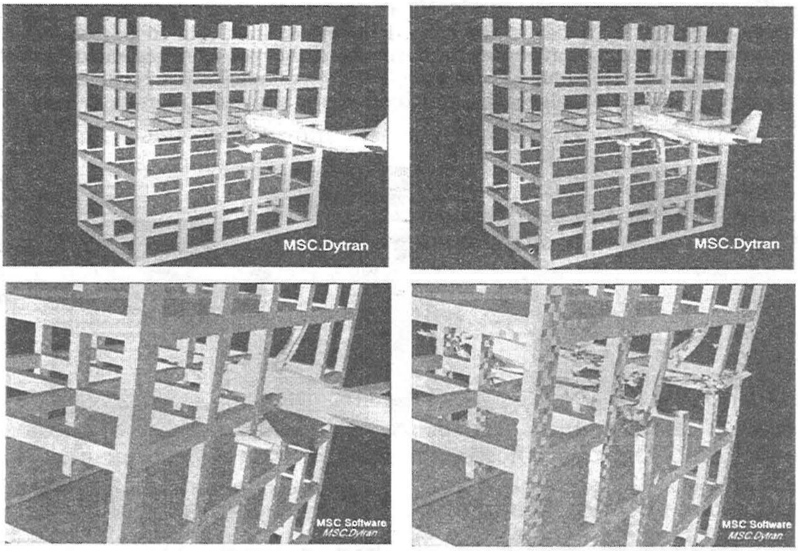


Fig. 5. Results of simulation analysis of impact of a 747 jetliner crashing into a steel structure. Notice fracture of the steel column and breaking of the plane due to dynamic stresses (Graphics and analysis by MSC Software Corporation)

- *Should the Federal Emergency Management Agency (FEMA) and/or Congress develops a more comprehensive protocol—for how to conduct investigations in response to natural disasters and/or terrorist attacks?*

The earthquake engineering community has conducted post disaster investigations very successfully and systematically within the Earthquake Engineering Research Institute and funded by NSF and FEMA for several decades. As a result of such post-disaster investigations, the lessons learned and the continued research and technology developments, great advances have been made in mitigating earthquake hazard. The approach taken in earthquake engineering can equally be applied to investigation of damage due to terrorist attacks as well as to minimizing consequences of such attacks. Due to criminal nature of terrorist attacks and higher priority placed on criminal investigation over engineering investigation, it appears that there is a need for a protocol to govern the availability of information and access to the site as well as interaction of the crime investigators and researchers investigating the scientific and engineering aspects of the terrorist attacks.

- *What areas of research into the WTC collapse still need to be addressed, and what is the most appropriate way to handle these needs?*

There are short-term and long-term research needs into the WTC collapse. In short-term, there is a need for a comprehensive, in-depth and research-oriented study of the WTC buildings from the time of plane impact, through the ensuing fire and the final collapse. Such studies not only should focus on structural and fire engineering aspects, but also social and human aspects of the tragedy as well. A broad based team of researchers and engineers from academia, government agencies and private sector, with expertise in various aspects of the problem need to be assembled to conduct such studies. In my opinion, such studies need to be directed by federal entities such as National Science Foundation (NSF) and/or National Institute of Standards and Technology (NIST) that are involved in directing and conducting scientific and engineering research. In December, the National Science Foundation sponsored a workshops organized by the Institute for Civil Infrastructure Systems of the New York University to identify research needs for future research related to WTC. A list of workshop recommendations can be found at *www.nsf.gov.* I participated at the workshop and feel that funding research in those areas will result in learning many valuable lessons from this tragedy and will result in significant improvements in the structural design, construction, fire protection, evacuation, fire fighting, rescue and recovery efforts, debris removal and many other aspects of protection of buildings and occupants against terrorist attacks.

In the long-term, there is a need for major and sustained finding to conduct basic and applied research on various aspects of terrorist attacks. Such research activities can result in development of scientific methods and technologies to assure life safety, prevent catastrophic collapses and massive loss of lives and minimize the impact of such attacks on the national economy and security. Last months, NIST held a workshop to identify research needs related to evaluation of performance and protection of buildings during intense fires. I also participated at this workshop and feel that the research areas identified at the workshop are very important in providing engineers and architects with the technologies to protect tall buildings, their occupants and firefighter and rescuers against catastrophic fires and resulting collapse.

In the aftermath of 9/11 tragedy and the hazard posed by terrorist attacks to public safety and the economical well being of the U.S. is not much different than the hazard posed by other "extreme events" such as major earthquakes three or four decades ago. In the case of seismic hazard mitigation, Congress, by providing sufficient funding to the National Science Foundation and other agencies involved, has enabled research and engineering community to develop efficient and economical technologies to mitigate seismic hazard and to prevent catastrophic loss of lives. To prevent catastrophic consequences of terrorist attacks, we need to develop and fund a long-term plan of research, perhaps modeled after seismic research programs developed and supported over the years by NSF and FEMA, and in the field of protection of built environment against terrorist attacks.

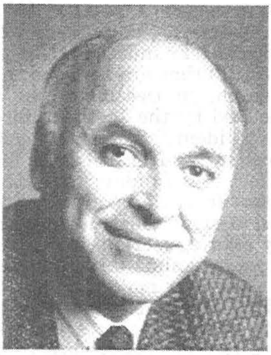
- *Has the confidential nature of the FEMA's Building Performance Assessment Team investigation made it more difficult to gain access to materials that might be useful, such as private videotapes?*

I have not been provided with the information made available to the FEMA Building Performance Assessment Team. This includes, videotapes and photographs taken on 9/11 and the following days and copies of the engineering drawings. At this time, having the videotapes, photographs and copies of the drawings not only is useful, but also is *essential* in enabling us to conduct any analysis of the collapse and to formulate conclusions from our effort.

I have been the Principal Investigator in conducting research on damage and collapse of several major buildings and bridges in the aftermath of earthquakes. I understand and respect the concerns of owners, designers, builders and those who are responsible for safe operation of these structures for possible legal ramifications of findings of our research investigations. However, the main objective of our research is to understand how the WTC buildings failed and learn lessons that can be used to prevent such collapses in the future. Never before my research results have been used in any legal proceedings. However, to allay any concerns that any findings of our research project might increase the liabilities of the City, Port Authority or Silverstein, the data on these structures could be provided to the Principal Investigator (myself) on a propriety basis. The Principal Investigator would keep the data and provide the other members of the research team with the information on a need-to-know basis. I have followed similar procedures to the satisfaction of parties involved in conducting research on major buildings and bridges subjected to earthquakes and blasts due to terrorist attacks.

I would like to take this opportunity and thank Chairman Boehlert and members of the Committee on Science for inviting me to testify. I would like now to welcome any questions that you may have.

BIOGRAPHY FOR ABOLHASSAN ASTANEH-ASL



Ph.D., P.E., Professor, Department of Civil and Environmental Engineering, 781 Davis Hall, University of California, Berkeley, CA 94720–1710; e-mail: astaneh@ce.berkeley.edu; Phone: 510–642–4528

EDUCATION:

M.S.E. (1979) and Ph.D. (1982) from the University of Michigan, Ann Arbor

CURRENT POSITION:

Professor, University of California at Berkeley

PROFESSIONAL MEMBERSHIP:

American Society of Civil Engineers (ASCE), Council on Tall Buildings and Urban Habitat (CTBUH), Earthquake Engineering Research Institute (EERI), Structural Stability Research Council (SSRC), Research Council on Structural Connections (RCSC), Consortium of Universities for Research in Earthquake Engineering (CUREE), Advisory Committee AC4 and Technical Committee TC8 of Eurocode Europe, Structural Engineers Association of Northern California, (SEAONC), Structural Steel Educational Council, (SSEC), Committee on Design of Blast-Resistant Steel Structures (AISC)

PROFESSIONAL REGISTRATION:

Registered Professional Engineer, P.E. (California)

MAJOR AWARD:

Winner of 1998 T.R. Higgins Award, American Institute of Steel Construction

TEACHING:

Has taught courses since 1982 on Engineering Mechanics, Static, Design of Steel Structures, Advanced Steel Design, Design of Steel and Composite Structures, Inelastic Behavior and Plastic Design of Steel Structures, Comprehensive Design of Structures. He has also taught a number of short courses to professionals on design of structures and earthquake engineering particularly on bridges to Caltrans engineers and others.

MAJOR RESEARCH & DEVELOPMENT PROJECTS DURING LAST FIVE YEARS:

1. “Tests of Critical members of the Golden Gate Bridge,” (Funded by Golden Gate Bridge), 95–96.
2. “Shake-table Tests of Computers with and without Support Restrainers,” 96–97.

3. “Cyclic Behavior and Seismic Design of Steel Piles,” (Funded by Caltrans), 96–98.
4. “Nonlinear Analyses of the Suspension Spans of the Bay Bridge,” (Funded by LLNL & UCB), 95–98.
5. “Seismic Behavior and Design of Shear Connections,” (Funded by FEMA/SAC), 97–98.
6. “Cyclic Tests and Seismic Design Provisions for Steel Shear Walls,” (Funded by GSA), 99–101.
7. “Cyclic Tests of Traditional and Innovative Composite Shear Walls,” (Funded by NSF), 98–present.
8. “Testing and Studying Blast-Resistant Structures,” (Funded by GSA and AISC), 97–present.
9. “Studies of Collapse of the World Trade Center,” (Funded by NSF), 01–present.

PUBLICATIONS

Has published more than 150 papers, reports and other publications on the behavior and design of steel structures subjected to seismic, gravity and blast loads.

UNIVERSITY OF CALIFORNIA, BERKELEY

BERKELEY - DAVIS - IRVINE - LOS ANGELES - RIVERSIDE - SAN DIEGO - SAN RANCISCO
SANTA BARBARA - SANTA CRUZ

ABOLHASSAN ASTANEH-ASL, Ph.D., P.E.
Professor
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
781 DAVIS HALL
BERKELEY, CALIFORNIA 94720-70 1 0

Telephone: (510) 642-4528
E-mail: Astaneh@ce.berkeley.edu
Web page: www.ce.berkeley.edu/~astaneh

March 5, 2002

Congressman Sherwood L. Boehlert
Chairman
House Science Committee, U.S. House of Representatives
Suite 2320 Rayburn House Office Building
Washington DC 20515-8301

Subject: Financial Disclosure

Dear Chairman Boehlert:

I am writing to provide you with financial disclosure on amounts of federal funding that I have received during the current and either of the two preceding years which directly supports the subject matter on which I am testifying. In the aftermath of the 9/11 I submitted a research proposal to the National Science Foundation and received a research grant to conduct research on: “World Trade Center Reconnaissance and Collection of Perishable Structural Engineering Data”. More information on the award and a copy of the proposal can be found at www.nsf.gov. The grant was awarded by the Engineering Directorate of the National Science Foundation. The total amount of founding awarded for this grant to the University of California Berkeley is $20,000. The bulk of this budget is allocated to travel expenses, student and supply payments. I will not personally receive any funds from this account.

Sincerely

Abolhassan Astaneh-Asl
Professor and Principal Investigator1

Chairman BOEHLERT. Thank you very much, Dr. Astaneh, and I especially appreciate your very specific recommendations. Dr. Bement. Doctor, microphone, please.

STATEMENT OF DR. ARDEN L. BEMENT, JR., NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY

Dr. BEMENT. Got it, I think. Mr. Chairman, Ranking Member Hall, and, Members of the Committee, thank you for this opportunity to testify on this role in the investigation into the collapse of the World Trade Center towers.

The collapse of these towers was the worst building disaster in human history. Engineers, emergency responders, and the Nation did not anticipate, and were largely unprepared, for such a catastrophe.

Shortly after the attacks on the World Trade Center, NIST's building and fire researchers began assisting Federal and local agencies in many ways to investigate the spread of fire through the buildings and their subsequent collapse. Using preliminary information from videos of the attack, our researchers were able to use previously developed computer models to simulate the spread of fire and smoke in the buildings.

At FEMA's request, NIST conducted a comparison and analysis of the current building and fire codes of New York City with national codes. This report has now been submitted to FEMA, and, I believe, it has also been submitted to the Committee.

One of our researchers participated in the initial assessment of the WTC collapse, conducted by the American Society of Civil Engineers, and we are lending our expertise in structural disasters to ASCE and the Structural Engineers Association in New York by storing steel from the World Trade Center at our Gaithersburg headquarters for further scientific study.

Additionally, NIST is working informally with a coalition of organizations from industry, standards bodies, code regulators, professional groups, and Federal agencies, as well as academics, in an effort to launch a comprehensive, public/private response program to address critically and urgently needed improvements to national building and fire standards, codes, and practices.

The events of September 11 have brought even more focus and priority to this already important issue. As part of this broader effort, NIST recently conducted a two-day workshop on fire resistance determination and performance prediction that brought together leading international experts and practitioners and academic faculty to define research needs in this area.

And NIST is organizing a workshop later this spring to establish a national plan for prevention of progressive structural collapse. The workshop steering committee consists of leading practitioners and key Federal partners from the Defense Threat Reduction Agency, the U.S. Army Corps of Engineers, the General Services Administration, and FEMA.

NIST has been responsive to all requests for technical assistance. In February, FEMA communicated to NIST its support of a NIST-led technical investigation of the building and fire safety issues related to the WTC disaster under our existing legislative authorities.

As required by our legislative authorities, we have consulted with local officials on a possible investigation and we have received uniform support. Mr. Chairman, at this time, I would like to submit for the record letters expressing support for, and cooperation in, such an investigation from FEMA and the local authorities.

Chairman BOEHLERT. Without objection, so ordered.

Dr. BEMENT. NIST is currently working very closely with FEMA and the Administration on this investigation since an in-depth technical investigation and broader response program would go well beyond the scope of the building performance assessments conducted by FEMA.

One part of our proposed funding plan for the broader program includes a soon-to-be submitted reprogramming of funds from our NIST-based budget. And it is my understanding that should be on the Hill today. In addition, the President's fiscal year 2003 budget request, a $2 million increase, will go toward this effort.

The NIST-proposed investigation would examine the building construction, the integrity of the materials used, and the technical conditions that combined to cause the World Trade Center disaster. Our efforts would involve the participation of technical experts from industry, academia, and other laboratories, as well as liaison with federal, state, and local authorities.

The steel currently stored at NIST could provide useful information to evaluate the quality of steel used in the construction of the buildings, to determine the maximum temperature reached by the steel in the region of severe fires where collapse initiated, and to identify the possible mechanisms of failure based on visual observations of failed components.

The results from the proposed investigation would be extremely valuable, but they are meaningless unless we take the knowledge gained and put it to practical use. That is why NIST is working with FEMA in the private sector on the broader effort that I mentioned earlier.

Specific improvements to building and fire practices, standards, and codes can only be identified if we are able to determine the exact sequence of events that led to the progressive collapse of the buildings and the associated loss of life and injuries.

Fire played a critical and visible role in the collapse of the WTC buildings and contributed to the Pentagon's damage. Current building design practice does not consider fire as a design condition. We now have the capability to simulate building fires on the computer to explain critical events and outcomes to an extent previously not possible.

In short, we could provide the technical basis and guidance for fire safety design and retrofit of structures, the predictive tools and test methods for fire-resistance determination, and the performance criteria for fireproofing materials. In addition, there are many critical gaps in our understanding of human behavior, protection, emergency response, and mobility as they relate to fires and other similar disasters that could also be addressed.

Thank you, Mr. Chairman, and I would be pleased to respond to questions from the Committee.

[The prepared statement of Dr. Bement follows:]

PREPARED STATEMENT OF ARDEN L. BEMENT, JR.

Good afternoon Chairman Boehlert, Ranking Member Hall, and Members of the Committee. I want to thank you for this opportunity to testify on the investigation into the collapse of the World Trade Center Towers. The tragedy that the United States experienced on September 11, 2001, was unprecedented when compared with any prior accident, natural disaster, or terrorist/war attack. The collapse of the twin World Trade Center towers was the worst building disaster in human history. Engineers, emergency responders, and the nation did not anticipate, and were largely unprepared for, such a catastrophe. Among other national needs, these events highlight the following technical priorities:

- To establish the probable technical causes of the collapses and derive the lessons to be learned;
- To develop and disseminate immediate guidance and tools to assess and reduce future vulnerabilities; and
- To produce the technical basis upon which cost-effective changes to national practices and standards can be developed.

Shortly after the attacks on the World Trade Center, NIST's building and fire researchers began assisting federal and local agencies in many ways to investigate the spread of fire through the buildings and their subsequent collapse. Our researchers used previously developed models along with preliminary information from videos of the attack and other sources to simulate the spread of fire and smoke in the buildings. At the request of the Federal Emergency Management Agency (FEMA), NIST conducted a comparison and analysis of the current building and fire codes of New York City with national codes, and we contributed to the Army Corps of Engineers' study of the structural and fire damage to the Pentagon. In addition, NIST experts participated in the initial assessment of the collapse conducted by the American Society of Civil Engineers (ASCE) Coalition that comprised a Building Performance Assessment Team (BPAT) funded by FEMA. The ASCE Coalition Team also included professional members of the Society of Fire Protection Engineers (SFPE), the National Fire Protection Association (NFPA), the American Institute of Steel Construction (AISC), and the Structural Engineers Association of New York (SEAoNY). NIST is lending its expertise in structural disasters to ASCE and the Structural Engineers Association of New York (SEAoNY) to store WTC steel at its Gaithersburg, MD, headquarters for further scientific study.

However, more needs to be done. A growing number of technical experts, industry leaders, and families of victims are pressing for a broad-based Federal investigation to study the building construction, the integrity of the materials used, and all the technical conditions that combined to cause the building disaster at the World Trade Center *[Witness would like to submit for the record, letters received supporting a federal investigation]*. NIST has begun working informally with a coalition of organizations—representing key industry, standards, codes, and professional groups—in an effort to launch a comprehensive public-private response program that includes such an investigation. NIST is also working very closely with FEMA, since an in-depth technical investigation would go well beyond the scope of the building performance assessments conducted by FEMA following major disasters. The implementation of the results of such an investigation would be critical to restore public confidence in the safety of tall buildings nationwide, enhance the safety of fire and emergency responders, and better protect people and property in the future. To cite one example, the February 4th issue of "Crain's New York Business" reports that an increasing number of tenants are leaving the Empire State Building, which is again the tallest building in New York City, because of fears of another terrorist attack. Anecdotal evidence also suggests that building vacancy rates have doubled in Manhattan, despite the 15 million square feet of space that was lost on September 11th.

NIST has received policy approval from the Secretary of Commerce to initiate and, after consultation with local officials, to conduct an independent and comprehensive "National Building and Fire Safety Investigation of the World Trade Center Disaster" under NIST's existing legislative authorities (15 U.S.C. 281a). Among Federal laboratories, NIST is uniquely qualified to conduct such a comprehensive investigation. The Building and Fire Research Laboratory is the foremost fire research laboratory in the United States, and through the National Earthquake Hazards Reduction Program (NEHRP) NIST is the principal agency for research and development to improve building codes and standards. NIST has extensive experience and expertise in conducting disaster investigations following structural/construction failures, fires, earthquakes, hurricanes, and tornadoes. These have included the well-known investigations into the 1981 collapse of a walkway in the Kansas City Hyatt Regency Hotel, the 1986 Dupont Plaza Hotel fire in San

Juan Puerto Rico, the 1994 Northridge earthquake collapses, and the 1995 Kobe, Japan earthquake building collapses, to name just a few. In compliance with statutory requirements NIST has already consulted with local authorities in New York, including the Port Authority of NY & NJ, the Mayor's Office of Emergency Management, the New York City Department of Design and Construction, and the Fire Department of New York. These organizations have expressed support for NIST and agreed to cooperate in it's investigation.

The proposed investigation would involve world-class experts from industry, academia, and other laboratories to complement NIST's excellent in-house technical expertise. Supplementing the outstanding work done through the building performance assessment team initially assembled through FEMA, NIST would delve deeper into the factors related to the collapse. NIST would use the results of the soon to be released ASCE Coalition team's study as a valuable source of input into the investigation. The objectives of the NIST investigation would be to determine technically:

- Why and how the World Trade Center buildings collapsed following the impacts of the planes;
- Why the injuries were so high or low depending on location, including all technical aspects of fire protection, response, evacuation, and occupant behavior and emergency response;
- Whether or not state-of-the-art procedures and practices were used in the design, construction, operation, and maintenance of the World Trade Center Buildings; and
- Whether there are new technologies or procedures that should be employed in the future to reduce the potential risks of such a collapse.

The NIST investigation would focus primarily on World Trade Center Buildings 1 and 2 (the Twin Towers) for several reasons. First, the collapse of the Towers was the triggering event that caused much of the collateral damage to the adjacent properties. Second, many structural and fire protection design features and construction details found in the Towers are widely used in the building construction industry. Third, to study procedures and practices used to assess the safety of innovative structural systems and building designs not covered by existing building codes or prior in-use experience as was the case of the twin towers, and whether such practices are adequate to detect and remedy inherent vulnerabilities. Fourth, to study procedures and practices used to provide adequate structural reserve capacity to resist abnormal loads (e.g., blast, explosion, impact due to aircraft or flying debris from tornadoes, accidental fires, and faulty design and construction), especially those that can be anticipated prior to construction (e.g., impact of a Boeing 707). Fifth, the Twin Towers would provide the opportunity to study the effectiveness of fire protection and firefighting technologies and practices for tall buildings, including emergency mobility and egress, and communication systems. And lastly, the analytical tools used in these investigations would be experimentally verified and widely applicable to other building types. Besides the Towers, the investigation would possibly consider examining WTC Building 7, which collapsed later in the day.

NIST would use an open and inclusive process in formulating its work plan for the investigation. This would involve the participation of technical experts from industry, academia, and other laboratories as well as liaison with federal, state, and local authorities. NIST would expect to complete its investigation and issue a final report in 24 months.

The results of the proposed investigation would be extremely valuable in establishing the probable technical causes of the disaster and deriving the lessons to be learned, but it would be meaningless unless we take the knowledge gained and put it to practical use. That is why NIST, in partnership with FEMA and a number of private sector organizations, has developed a broader response program. This broader program would address critically and urgently needed improvements to national building and fire standards, codes, and practices that have begun to be recognized in recent years. The events of September 11th have brought even more focus and priority to this already important issue.

The goal of this broader program would be to produce cost-effective retrofit and design measures and operational guidance for building owners and emergency responders. The program would develop and disseminate guidance and tools to assess, and produce the technical basis and recommendations for cost-effective changes to reduce vulnerabilities.

Over the course of the proposed investigation and broader program there would be a number of short-term and interim work products that would provide guidance, tools, and technical assistance to better prepare facility owners, contractors, designers, and emergency personnel for future disasters. Some of these products, based on prior NIST work, would be disseminated broadly as soon as possible. Others that need further refinement would be disseminated within a year, and the rest after the completion of the investigation. I would like to note that the President's FY 2003 budget request for NIST contains a $2 million funding increase, which will go towards this effort and related research.

Let me now give you three examples of work that would be accomplished through this broader program.

First, *fire* played a critical and visible role in the collapse of the WTC buildings and contributed to damage to the Pentagon buildings. Current building design practice does not consider fire as a design condition. Instead, structural fire endurance ratings are prescribed in building codes using standard tests on individual components. The current testing standards are based on work carried out at NIST in the 1920s. They do not represent real fire hazards in modern buildings. They also do not consider the fire performance of structural connections or of the structural system as a whole, or the multiple performance demands on fire proofing materials. NIST now has the capability to simulate building fires on the computer to explain critical events and outcomes to an extent previously not possible. The proposed work would expand on this core competence in computational methods, and adapt measurement techniques and test methods to support the prediction of performance of building materials, products, structural elements, and systems up to the point of the collapse of a tall building due to fire. In short, NIST would provide the technical basis and guidance for fire safety design and retrofit of structures, the predictive tools and test methods for fire resistance determination, and the performance criteria for fireproofing materials. In addition, NIST proposes to develop guidance and retrofit technologies to enhance building egress in emergencies, practical tools and guidance to enhance the safety and effectiveness of fire and emergency responders, and improved models of occupant behavior and response to enhance evacuation and communication in emergencies.

Second, *progressive collapse*—which refers to the spread of failure by a chain reaction that is disproportionate to the triggering event—was also responsible for the extraordinary number of deaths in the 1995 bombing of the federal building in Oklahoma City. Yet, the United States has not developed standards, codes, and practices to assess and reduce this vulnerability. Adding to the problem for modern structures is their smaller margin of safety—and the reserve capacity to accommodate abnormal loads—due to increased efficiency in the use of building materials and refinements in analysis techniques. The work carried out at NIST in the early 1970s continues to provide the basis for the extremely limited guidance that is available in current United States standards. NIST would develop cost-effective solutions to reduce building vulnerability to progressive collapse using a multi-hazard approach that exploits synergies in resisting extreme loads from blast, impact, earthquakes, and fires.

Third, *vulnerability reduction of commercial and institutional buildings and facilities.* The overwhelming majority of buildings in public use today are vulnerable to terrorist attack on a number of fronts. Most lack state of the art sensing and information management systems. Few have electronic representations of the building documents or models, and standards do not exist for such representations. Most are not protected against chemical, biological, and radiological (CBR) threats. While efforts are underway to protect military buildings through Department of Defense's "immune buildings" program, there are no standards and practices for civilian buildings. NIST proposes to work with the DOD to develop guidelines and advanced technologies to reduce the vulnerability of such buildings to CBR attacks. NIST also proposes to work with industry to develop standards for building information models and information exchange, and practicable tools for helping building owners make reasoned economic choices in reducing the vulnerabilities of their buildings.

The final program element supports a construction-industry-led roadmapping effort to reflect changed priorities for development and deployment of safety and security standards, technology, and practices. It would also support the delivery and dissemination of practical guidance, tools, and technical assistance to better prepare facility owners, contractors, designers, and emergency personnel to respond to future disasters and to speed economic recovery within the industry following disasters. The effort would complement and support parallel efforts of technical organizations to improve standards, codes, and practices.

In conclusion, I believe it is imperative for the U.S. to learn from the worst-ever building disasters in human history and take aggressive remedial action to minimize future losses. As the events of September 11 demonstrated, the very stability of U.S. commerce and our economy depends upon major buildings and critical facilities that provide a key part of our Nation's physical infrastructure. In the wake of September 11th, the private sector's willingness to take necessary corrective action to strengthen building codes and standards is extraordinarily strong. So with the envisioned Federal technical leadership and partners from the private sector, changes can be made to minimize the likelihood and consequences of future disasters. Thank you, Mr. Chairman. I would be happy to take questions from the Committee.

BIOGRAPHY FOR ARDEN L. BEMENT, JR.

Purdue University News Service

Arden L. Bement, Jr., was sworn in as the 12th director of NIST on Dec. 7, 2001. Bement oversees an agency with an annual budget of about $812 million and an on-site research and administrative staff of about 3,000, complemented by a NIST-sponsored network of 2,000 locally managed manufacturing and business specialists serving smaller manufacturers across the United States. Prior to his appointment as NIST Director, Bement served as the David A. Ross Distinguished Professor of Nuclear Engineering and head of the School of Nuclear Engineering at Purdue University. He has held appointments at Purdue University in the schools of Nuclear Engineering, Materials Engineering, and Electrical and Computer Engineering, as well as a courtesy appointment in the Krannert School of Management. He was director of the Midwest Superconductivity Consortium and the Consortium for the Intelligent Management of the Electrical Power Grid.

Bement came to his position as NIST Director well versed in the workings of the agency, having previously served as head of the Visiting Committee on Advanced Technology, the agency's primary private-sector policy adviser; as head of the advisory committee for NIST's Advanced Technology Program; and on the Board of Overseers for the Malcolm Baldrige National Quality Award.

Bement joined the Purdue faculty in 1992 after a 39-year career in industry, government, and academia. These positions included: vice president of technical resources and of science and technology for TRW Inc. (1980–1992); deputy under secretary of defense for research and engineering (1979–1980); director, Office of Materials Science, DARPA (1976–1979); professor of nuclear materials, MIT (1970–1976); manager, Fuels and Materials Department and the Metallurgy Research Department, Battelle Northwest Laboratories (1965–1970); and senior research associate, General Electric Co. (1954–1965).

Along with his NIST advisory roles, Bement served as a member of the U.S. National Science Board, the governing board for the National Science Foundation, from 1989 to 1995. He also chaired the Commission for Engineering and Technical Studies and the National Materials Board of the National Research Council; was a member of the Space Station Utilization Advisory Subcommittee and the Commercialization and Technology Advisory Committee for NASA; and consulted for the Department of Energy's Argonne National Laboratory and Idaho Nuclear Energy and Environmental Laboratory.

He has been a director of Keithley Instruments Inc. and the Lord Corp. and was a member of the Science and Technology Advisory Committee for the Howmet Corp. (a division of ALCOA).

Bement holds an engineer of metallurgy degree from the Colorado School of Mines, a Master's degree in metallurgical engineering from the University of Idaho, a Doctorate degree in metallurgical engineering from the University of Michigan, and a Honorary Doctorate degree in engineering from Cleveland State University. He is a member of the U.S. National Academy of Engineering.

DISCUSSION

Chairman BOEHLERT. Thank you very much, Dr. Bement. And thank all of you. And the Chair is going to be somewhat arbitrary in the initial round of questioning, restricting, including the Chair, to five minutes, and then we will have a second round and as many rounds as are necessary.

Mr. Shea, in your statement, you said rightly so that FEMA's singular goal in the immediate aftermath of the attack was to support local jurisdictions in the rescue of trapped firefighters and workers. Nothing had a higher priority.

Mr. SHEA. Right.

Chairman BOEHLERT. And I can certainly understand that. But can you explain why the BPAT team was not able to enter the site until October, even though volunteers were at the site almost immediately and the ASCE team was in place within days? Why October?

Mr. SHEA. Perhaps, the best way to do this—Dr. Corley, maybe you can help explain why we were there in October.

Dr. CORLEY. Yes. I can add some information to that. The team, as it was officially put together, indeed, did not get to the site until October. However, as early as the Saturday after the attack, we had at least three people who, at that time, were on our team, onsite, in connection with the search and rescue, and they were beginning to collect information at that time.

Chairman BOEHLERT. But mostly observing. I mean, the most important thing going on right then was the search and rescue effort, but there was no organized effort to gather evidence, if you will. And I know there is some dispute between you and Dr. Corbett in your statements where you say the investigation or the review has not been compromised because of so-called lost evidence, and Dr. Corbett feels it was. In fact, it seems to me an inordinate amount of time before the BPAT team was in there really doing something. A couple of people there is not what I would consider the type of response necessary.

Dr. CORLEY. Yes. Well, those people were, indeed, collecting very vital information to us. But the reason that we were unable to get in until that time was that the combination of the search and rescue and the criminal investigation were the things that we understand, at least, were preventing us from getting access.

Chairman BOEHLERT. Well, they were more of observers. They didn't have badges. They weren't there in any official capacity that anyone could identify. But—well, that is something we are going to——

Mr. CORBETT. Yes.

Chairman BOEHLERT [continuing]. Talk more about. And, incidentally, these questions today—we are not going to get to all the questions obviously, and we are determined to be as thorough as possible. So—and this is not coming out of my time because I am making this observation from the chair. But we are going to follow up with very specific questions and we want specificity in your responses in a very timely manner. We are all very serious about this. And our objective is not to point fingers at anyone. Our objective is to get to the bottom of it and to make certain we do what is necessary to prevent something like this from ever happening again.

Dr. Bement, you know, why did NIST play initially, at least it appears to us, sort of a passive and minor role in getting on with the investigation? Is it because there is no clear definition of who has responsibility for what?

Dr. BEMENT. Well, I take your question as support for the fact that we should do this investigation, except we should have done it sooner, perhaps.

Chairman BOEHLERT. I agree. And I agree.

Dr. BEMENT. The role of NIST is somewhat circumscribed by statute. We——

Chairman BOEHLERT. And where things are circumscribed, we are going to make it crystal clear——

Dr. BEMENT. Thank you.

Chairman BOEHLERT [continuing]. So there is no doubt in the future.

Dr. BEMENT. We have anxiety about that. As a matter of fact, we have been a very strong advocate for this establishment of a National Construction Studies Board that would operate very similar to a National Transportation Studies Board that would overcome some of the deficiencies in being able to carry on the timely investigation that you are talking about. And we, at NIST, would be very happy to work with the Committee in developing that policy.

Chairman BOEHLERT. Staff has just pointed out to me that very specifically in the law, the National Institute of Standards and Technology, on its own initiative, but only after consultation with local authorities, initiates and conducts investigations to determine the causes of the structural failures and etcetera, etcetera.

Dr. BEMENT. That is correct. But we will work with you. As a matter of fact, acting on that authority, I requested the reprogramming action that is coming up to the Hill now to provide the funding to continue the work that we are currently doing. Also, during the months of November and December, we did have numerous meetings with authorities in New York to do just what this authority requires—consultation with the local authorities. And the letters that I submitted for the record are in response to those meetings and those understandings.

We felt it was very important early to get full concurrence and full cooperation because of the vital information that is held by the Port Authority, by the designers of the building, and other sources of vital information. So we have been marshaling that support.

Chairman BOEHLERT. You know, one of the things that really bothers me is we don't have a system in place where there is immediacy to get a team onsite, not to interfere in any way, shape, or manner with search and rescue, because that is the most important——

Dr. BEMENT. Right.

Chairman BOEHLERT [continuing]. Activity of all—but a team onsite to immediately begin to have a video and oral history of what happened and when it happened. And I noticed in some of the testimony—and I have spent hours reading all the testimony, because

I want you to know this—I am not the only one—we are all very serious about this mission.

Dr. BEMENT. Right.

Chairman BOEHLERT. But I noticed the networks have been asked to cooperate, and they have been, but slowly. And as we are assembling this whole record of what happened in the film—but wouldn't it seem to make sense that we have somebody, whether it is in the NIST shop or FEMA shop, or somebody, a team of people immediately onsite at a disaster, particularly one of this magnitude——

Dr. BEMENT. Yes.

Chairman BOEHLERT [continuing]. To start recording?

Dr. BEMENT. I fully agree.

Chairman BOEHLERT. And so that we don't have Dr. Corley and Dr. Corbett at odds some time in the future as we are conducting this review. Dr. Corley says he doesn't feel the investigation was compromised because we have enough steel. A lot of people say a lot of that steel is gone. We don't have the evidence we need to investigate to know what happened and when. But if we had that immediate team of people——

Dr. BEMENT. Right.

Chairman BOEHLERT [continuing]. With a video and oral history of it being recorded, that would——

Dr. BEMENT. A video record would have been—or a photographic record of some of these pieces would have been terribly important.

Chairman BOEHLERT. Yeah. Listen, I could occupy this whole morning and this whole afternoon, and this whole week with questions, but my time has expired. We will have another round. Mr. Weiner, you are next.

Mr. WEINER. Thank you, Mr. Chairman. And I have a question for the Panel. Will the person who is in charge of the investigation raise their hand? [ ] Well, that was two hands and one flinch. Who is——

Dr. BEMENT. Oh. No. I——

Mr. WEINER. Oh. That is a third hand.

Dr. BEMENT. I have authority for the investigation.

Mr. WEINER. Okay. And, Dr. Astaneh, why do you raise your hand if he is in charge? Yes, sir.

Chairman BOEHLERT. Dr. Astaneh, do you want to respond?

Dr. ASTANEH-ASL. I thought you asked, raise your hand if you are—you were investigating?

Mr. WEINER. No. I want to know who is in charge. Where does the buck stop on this panel on this investigation? Oh, no one. Yes, sir. Okay.

Dr. BEMENT. No. It depends when you ask your question or when you reference your question. NIST operates under the Federal Response Plan where we provide technical support to the emergency agencies that have responsibility for the emergency. This would be FEMA, primarily, and the Corps of Engineers——

Mr. WEINER. Dr. Bement, if you will forgive me, I have a very brief amount of time. Are you in charge of the investigation in to why the World Trade Center collapsed?

Dr. BEMENT. I now have authority to conduct this investigation. Yes.

Mr. WEINER. Okay. Is that as of—as of when?

Dr. BEMENT. Well, as of the concurrence of FEMA and the approval of the Secretary of Commerce.

Mr. WEINER. Okay. So if you are in charge, are you in power to sequester evidence?

Dr. BEMENT. Not under subpoena. But——

Mr. WEINER. Are you—all right. That was going to be my next question. Are you in power to issue a subpoena requiring that someone turn over a building plan?

Dr. BEMENT. Not at this time.

Mr. WEINER. Are you in power to require someone to provide information if they might have it?

Dr. BEMENT. Not under any mandatory conditions, but we can request and——

Mr. WEINER. Do you have the ability to visit Ground Zero this morning, point to a piece of steel and say, I need you to save that?

Dr. BEMENT. I can do that. Yes.

Mr. WEINER. You have the power and the law to do that?

Dr. BEMENT. I think I can do that now. Yes.

Mr. WEINER. I am sorry.

Dr. BEMENT. I think I can do that now.

Mr. WEINER. Do you need to check with a member of your staff? I mean, what do you mean, you think—can you or—it is not a—this is an easy part, I thought.

Dr. BEMENT. Well, as I said, I don't have subpoena authority and I have to work through FEMA. And I don't have control of the site. So I have limited——

Mr. WEINER. Has anyone——

Dr. BEMENT [continuing]. Authorities——

Mr. WEINER. Dr. Bement, has anyone——

Dr. BEMENT. And, incidentally——

Mr. WEINER. Yes.

Dr. BEMENT [continuing]. Just to take a second, again, we have to operate under the concurrence of local authority.

Mr. WEINER. Well, I recall being in—on Beach 130th Street in Rockaway watching the National Transportation Safety Board point to pieces of evidence, say to the local law enforcement, don't touch this or it is going to be a felony if you do. Do you have that authority?

Dr. BEMENT. That is exactly the authority I am asking for in——

Mr. WEINER. Okay.

Dr. BEMENT [continuing]. Establishing the National Construction Safety Board that would have the same authorities as the National Transportation Safety Board.

Mr. WEINER. Well, as you heard in my opening statement, I concur.

Dr. BEMENT. Right.

Mr. WEINER. Can I ask members of the Panel—and I am not sure—perhaps, Dr. Corbett—if you were to look at a piece of steel that was affected in a catastrophic way, do we have the scientific ability to draw conclusions about what caused that piece of steel to fail? Dr. Corbett, I think I would address it to you, sir.

Mr. CORBETT. Okay. Yes. I think we do. As a matter of fact, I know we do. And that is——

Mr. WEINER. And might that piece of information be helpful in building future buildings?

Mr. CORBETT. Certainly.

Mr. WEINER. Would members—would you, Dr. Corbett, in looking at a bunch of steel that, to me, just might look like twisted steel, be able to say that given where this was in the building or what kind of a joint it was, this is more important than that?

Mr. CORBETT. Yes.

Mr. WEINER. Is anyone on—has anyone on the panel been offered the opportunity to go take a look at the steel that came from that site to say, I want to study this one? This one is less important. Has anyone on the Panel, by a show of hands, had the ability to do that? Dr. Corley—the steel that is being recycled now by the City of New York, which is about 80 percent, according to what I have been told—has that steel all been looked at by a member of a panel or a committee that is studying the causes of this disaster?

Dr. CORLEY. Not all of it has been looked at.

Mr. WEINER. Are you concerned that what Dr. Corbett has just said to me, that you can look at a piece of steel, draw conclusions about it, and help prevent future accidents, that we have now lost, irrevocably, the opportunity to draw those conclusions?

Dr. CORLEY. With that steel that has been recycled, we have lost any opportunity to do that, however, we have identified a large number of pieces of steel that will provide us with that type of information.

Mr. WEINER. And if I could ask one further question, because now the yellow light is on, to Dr. Bement. You said that we have the capability to determine the impact of heat on structural failure in buildings.

Dr. BEMENT. That is correct.

Mr. WEINER. If we had done that type of analysis before September 11, could we have drawn some conclusions about how long a building would withstand—a building like the World Trade Center, would withstand the amount of heat and energy that was let loose in that building?

Dr. BEMENT. In——

Mr. WEINER. Could we have said——

Dr. BEMENT. In principle, yes.

Mr. WEINER. Okay. So we could have said, and had written down somewhere, that someone could have checked or referred to, you know what, this building has, based on this amount of energy being released, about four minutes.

Dr. BEMENT. That is correct.

Mr. WEINER. Okay. Do you believe that if we had that information before September 11, some of the people that are sitting behind you would not have lost loved ones?

Dr. BEMENT. Perhaps. Yes.

Mr. WEINER. Thank you, Mr. Chairman.

Chairman BOEHLERT. Thank you. The gentleman's time has expired. Dr. Bement, when did the transition occur? When was the torch passed? Initially—I mean, we agree that in the final analysis, NIST should have the responsibility and you should have the resources to do what we expect you to do, but we were not aware that the torch had been passed from FEMA, which has first responsibility. When did this occur?

Dr. BEMENT. We have been in continuing consultation with FEMA over the past—well, since the event, as a matter of fact. And we have had discussions on how best NIST could serve in carrying out this investigation. And we have asked for concurrence, not only from local authorities, but also from FEMA. And you will note from their letter they have supported our investigation. So we feel we have their complete support and authority to carry out the investigation.

Chairman BOEHLERT. But you are now officially in charge—does FEMA agree with that—officially in charge of the review and the preparation of the report?

Dr. BEMENT. Well, I would say that we are operating as if we are in charge, and I assume that we are in charge.

Chairman BOEHLERT. But does FEMA agree?

Mr. SHEA. Mr. Chairman, I think the situation, to state it factually, is that we have a responsibility with FEMA to continue on through the production of this Building Performance Assessment Team report, which is scheduled for April. The results of that report, and, of course, the National Institute of Standards and Technology is a member of the team, will then be transmitted to NIST for their further examination. But they are currently partnering with us on that effort.

Chairman BOEHLERT. But would you—I mean, I think it is fair to say that for several months it has been uncertain who was clearly in charge.

Mr. SHEA. I think that is an accurate statement.

Chairman BOEHLERT. And I think it is also fair to acknowledge that this is unprecedented.

Mr. SHEA. Uh-huh.

Chairman BOEHLERT. Well, Mr. Shays.

Mr. SHAYS. Thank you, Mr. Chairman. And before you hit the dial, I would love to just, on behalf of Connecticut and New Jersey residents, just say that we, in New York, New Jersey, and Connecticut all felt the impact of this. And the district I represent is 25 to 50 miles away. We have guests in our audience who lost loved ones. Some grandparents were lost—parents, children, husbands, and wives. And we could see the smoke from our district and turn on our TV and see our loved one and neighbors enclosed, encased in a building they couldn't get out of, that imploded before their very eyes. And I just, on behalf of them, thank you for having these hearings.

Chairman BOEHLERT. Thank you, Mr. Shays. And now——

Mr. SHAYS. I——

Chairman BOEHLERT [continuing]. The clock will start running.

Mr. SHAYS. Thank you. I am kind of taken back by what has been said today and also by the excellent questions of Mr. Weiner. He is probably speaking a little loudly and a little quickly because he has five minutes, but his points are, I say—I think, tell it all. I am taken back, Mr. Shea, by your comment that no one thought these buildings would fall. And the fact that no one thought they would, but they did, would seem to me to be the very reason why we would have an investigation.

I am taken back by the fact that Dr. Bement said it is the worst building destruction in human history. So——

Dr. BEMENT. That is correct.

Mr. SHAYS [continuing]. You know, it is like nothing else needs to be said other than to wonder why this didn't happen sooner. And we all can look at ourselves, Members of Congress, we were probably too focused on how do we deal with this war on terrorism to deal with the mundane things that needed to be dealt with right away.

I am interested to know why these buildings imploded rather than toppled? I am interested to know if they had toppled, would there have been a domino effect and would one building have triggered the fall of another and triggered the fall of another. And, to me, these seem like very valid questions that have to be answered. And I am interested—you focused—Dr. Astaneh, you focused on the structure of the steel and didn't mention the fire, and, Dr. Bement, you basically focused on the fire. Just with the structure of the steel without the fire, would this building ever collapsed?

Dr. ASTANEH-ASL. No. In my opinion, the reason for collapse of building was because of the softening and weakening of the steel after the impact was done and the fire was going on.

Mr. SHAYS. But you showed the building when you took the plane away, but showed the damage, and you showed that basically some of the steel was just shot.

Dr. ASTANEH-ASL. Yes. But these structures—certainly these structures, the World Trade Center, were designed in a very redundant way, which means if you take many members out, still the remaining members can redistribute the load and carry the remaining the load. So even if you take a few columns—in this case, maybe 30 percent, 40 percent of columns were lost on one face of the building, the remaining columns were able to carry the load. If we did not have the fire, the buildings would have stood up as they did for one hour.

Mr. SHAYS. When we—when I was elected in '87, when Stewart McKinney passed away, at that very moment in time, we had the collapse of a lift-slab structure in Bridgeport, and it imploded. You know, one floor came down and then the others came down. Why didn't this building topple? And if it had toppled, would it have potentially knocked down other buildings?

Dr. ASTANEH-ASL. The collapse that you mentioned, as well as collapse of World Trade Center, the eventual cause of most collapses is the gravity. Buildings are standing up because we have supports under the floors and floors are supported on the columns. As soon as you remove the support, the gravity does the final damage and pulls the building down. In this case, because the fire damaged the columns and floors and softened them, the gravity is the cause that collapsed. That is why it imploded and came down.

To answer your question about whether or not it could be toppled, my own feeling initially was, and it still is, that they may have tried, these terrorists, to actually topple the buildings, which would have been a disastrous event, toppling those structures on the World Trade—on the Wall Street area.

But the structures were designed for a very high level of storm, very high level of force, and 707——

Mr. SHAYS. Thank you.

Dr. ASTANEH-ASL [continuing]. Airplane.

Mr. SHAYS. Dr. Corley, do you agree with that?

Dr. CORLEY. Yes. Dr. Astaneh is correct in what he said, that it is the gravity that is the primary cause.

Mr. SHAYS. Is there ever a concern about a domino effect?

Dr. CORLEY. In most buildings, no. In low buildings, in very high seismic regions, you may have enough lateral load resistance in the building that they can topple. And I have seen a few buildings do that in very high seismic zones. These buildings generally will start to topple over, but then gravity will take over and come down. Building #2 did, in fact, lean a fair amount before it came down.

Mr. SHAYS. Just very quickly, my last question. Mr. Shea, I noticed you getting a little uneasy when Mr. Weiner was asking questions as to whether Dr. Bement had the authority or not. And I was uneasy watching you——

Mr. SHEA. Okay.

Mr. SHAYS [continuing]. Frankly, because it does strike me that six months after the fact there shouldn't even have been any doubt. I mean, obviously, we have to deal with some statutory responsibilities and authority, but it sounds to me like you had the ability to give him power and he says he took it and accepts it. But why wasn't it clear?

Mr. SHEA. Well, let me, if I can, try and characterize that for you. From the—from day one, from the date of the disaster, when the President declared the disaster, FEMA had, and we undertook, our responsibilities to conduct a building performance assessment. But I think the question was different. The question was, who had the authority to investigate. We do not have authority to investigate. We do not have analogous authority to the NTSB or the FBI or other law-enforcement types of agencies.

What we did, and we continue to this day, to have the authority to carry forward with the Building Performance Assessment Team. And it is when that report is completed in April that we intend to, in effect, pass the baton on.

During the entire period of time, however, the American Society of Civil Engineers to the National Institute of Standards and Technology—they have all been partners in that effort. So if I was acting uncomfortable, it was because I was concerned about the way the questions were being phrased versus the answers.

Mr. SHAYS. Thank you. Thank you, Mr. Chairman.

Chairman BOEHLERT. Thank you. And, Mr. Shea, you have given a compelling argument for the need for an immediate development of a protocol so that we know clearly who is in charge.

Mr. SHEA. Yeah.

Chairman BOEHLERT. That is absolutely essential. And the immediate question I have—it appears that FEMA didn't talk to city officials about preserving or documenting the steel that was being removed from the site. Or at least, the city says FEMA never talked about it, which leads us to the Corley versus Corbett debate on what evidence was lost and how important it is to the overall investigation.

Does FEMA play an active role in facilitating the investigation? It seems to me you do. So——

Mr. SHEA. Well, clearly, in terms of facilitating any assessment of the activity, the answer is, yes, we do play a very pivotal role. Onsite, we have a Federal coordinating officer and a disaster field office operation. They do interface on a daily basis with most state and local government as part of the—any effort that goes on at the disaster site.

Chairman BOEHLERT. Didn't someone initially feel that all—with all this debris being hauled away—and we understand the necessity of doing that—but didn't someone think in terms of the investigation that would be conducted and the need for that material to be evidentiary?

Mr. SHEA. I think the answer is, yes, Chairman Boehlert. The day after the event, we began those discussions with the American Society of Civil Engineers and our prime contractor, Greenhorn and O'Mara to field a Building Performance Assessment Team on the ground. So the answer is, yes. I mean, we were considering it immediately in the aftermath.

Chairman BOEHLERT. We have been—and I have read all this testimony and talked to a lot of people, and, more importantly, listened to a lot of people.

Mr. SHEA. Yes.

Chairman BOEHLERT. And the three impediments—and Dr. Astaneh pointed them out—the access to the site, the access to the material, and the blueprints. And it was like four months after before anybody got the blueprints. This is a learning exercise——

Mr. SHEA. Absolutely.

Chairman BOEHLERT [continuing]. And we are all learning from what happened.

Mr. SHEA. Yeah.

Chairman BOEHLERT. And it is unprecedented, I understand. And we don't mean to assume an adversarial role. We are all in this together. We are not here, you know, sparring with you. We are just trying to get to the facts to know what we need to know so that we will know what we need to recommend so that something like this, one, will be prevented, but, two, if it happens, we will have the response capability that we need.

Just before I go to Mr. Weiner, just let me ask you—oh, who is that? Oh, Mr. Israel, you are next. I am sorry. Yeah. Weiner is sort of my buddy here. But do you feel, Mr. Shea, and do you feel, Dr. Bement, that you have the resources you need, to this juncture, to do what is expected of you? I know there are going to be requests for additional funds——

Mr. SHEA. Uh-huh.

Chairman BOEHLERT [continuing]. But I want to make certain that nothing is being impeded—no progress is being delayed because you don't have whatever you need. Do you feel that FEMA has the resources it needs to do what you are expected to do right now?

Mr. SHEA. The answer is, yes. But I think it also needs to go back to some of the other issues that you have raised, Mr. Chairman. The issues that we are now looking back on that I think this Committee is trying to address this afternoon, do need to be addressed as part of an overall strategy that the Federal Government will undertake. It is my opinion, based on my experience, that that is properly then vested in the National Institute of Standards and Technology in the kinds of authorities that Dr. Bement has outlined to you this afternoon.

In terms of conducting our business, what we were undertaking with the Building Performance Assessment Team, yes, we have sufficient resources to do that.

Chairman BOEHLERT. And how about you, Dr. Bement?

Dr. BEMENT. Well, there are three phases to this overall study, which, by itself, is going to take almost 24 months. There is a preliminary stage, in which we have been active. At the present time, we have the resources necessary to set the stage and get the necessary concurrences and to also obtain the materials that are available for metallurgical examination and forensic study. This is a study in itself, and Dr. Corley's estimate of what the resources require for that study are very close to the mark.

Chairman BOEHLERT. Where do the resources come for Dr. Corley's study? Does it come from FEMA?

Mr. SHEA. They were a combination of resources that the American Society of Civil Engineers put into the process——

Chairman BOEHLERT. Right.

Mr. SHEA [continuing]. Along with funding from FEMA.

Chairman BOEHLERT. All right. So you haven't had to put any resources into the BPAT yet. You have participated——

Dr. BEMENT. No. I am talking about resources that would have to support the consortium that NIST is organizing at the present time to carry on the full-scale study that we have been talking about. Those recommendations have gone up to the highest level of the Administration and I am very optimistic that it will be resolved very quickly.

The third phase, which will go in parallel with the investigation itself, is to take the lessons learned and provide the technical basis for changes in codes and standards, not only for existing buildings, but for new construction, to provide better security for occupants, to provide better egress, to provide better structural integrity under these types of impacts. In addition——

Chairman BOEHLERT. But there are going to be requests, obviously, but you—but the bottom line is, you feel you have what you need in terms of resources. I mean, transferability——

Dr. BEMENT. I don't think we have slowed down. We have got a team going. We have been coordinating with FEMA and other agencies. I think we are ready to go and I think the original——

Chairman BOEHLERT. And there will be no hesitancy—no hesitancy—to request additional resources.

Dr. BEMENT. No hesitancy. That is correct.

Chairman BOEHLERT. All right. That is good.

Dr. BEMENT. And, furthermore, I would say that we will build on the current BPAT study, which will be issued in April.

Chairman BOEHLERT. April.

Dr. BEMENT. And we have some of the results already, so we can—you know, as I say, we can——

Chairman BOEHLERT. But you are not waiting for that study to——

Dr. BEMENT. We are not waiting for that study.

Chairman BOEHLERT. All right. Fine. Mr. Israel.

Mr. ISRAEL. Thank you, Mr. Chairman. I would like to follow up on some of these questions regarding the resources that have been made available for these studies. To the Chairman's question, Mr. Shea, who used to be in charge of the investigation, said, we have enough. Dr. Bement, who I understand is now in charge of the investigation, says, we may have enough, depending on these phases. Dr. Corley says we need $40 million, and until we have $40 million, it is not enough. Can somebody explain to me exactly what it is going to take to do the kind of study we need to do to make sure that this doesn't occur in the future? Let us start with Dr. Bement.

Dr. BEMENT. Well, I think Dr. Corley was estimating what the cost of a study of this type would require. And, as I say, he is pretty close to the mark. We have developed——

Mr. ISRAEL. 40 million?

Dr. BEMENT. I won't put a number on it just yet.

Mr. ISRAEL. But the mark, I believe, is 40 million. What is close to the mark?

Dr. BEMENT. That was his estimate.

Mr. ISRAEL. Okay.

Dr. BEMENT. I am just saying it is not too far out of the ball park.

Mr. ISRAEL. Okay.

Dr. BEMENT. We will—we are working on a funding plan and that will come forward very quickly. As far as the investigation, it is a question of what you mean by the investigation. If you are talking about the technical investigation, which NIST is proposing doing, I am operating on the assumption that I have adequate authority to begin that technical investigation.

If you are talking about broader issues, with regard to responsibility and other ancillary items surrounding the World Trade Center collapse, which we are not going to be involved in, that is not in our camp at the present time.

Mr. ISRAEL. Dr. Bement, you had stated that, at this hearing, that NIST has received policy approval for this study. What does policy approval mean?

Dr. BEMENT. It means that under 15 U.S. Code, Paragraph 281(a), which the Chairman referred to, it gives us the authority to, on our own initiative, but only after consultation with local authorities, we may initiate and conduct investigations to determine the causes of structural failures that——

Mr. ISRAEL. Dr. Bement, I am sorry. I also have limited time. I am getting kind of a bureaucratic response. What does policy approval mean and how much is it going to cost to do what you have to do?

Dr. BEMENT. That is our policy approval right there. That gives me the authority——

Mr. ISRAEL. To do——

Dr. BEMENT [continuing]. With consultation and with adequate resources, to carry out the investigation.

Mr. ISRAEL. Okay. Adequate resources. Dr. Corley, what does $40 million get us that we are not getting right now?

Dr. CORLEY. The work that would be done with the $40 million would be to follow up on the many recommendations that will be coming out in our report where further study and, in some cases, research programs are needed to get answers to the questions. It would cover the issues of protection of the emergency response teams, as well as structural and fire issues.

Mr. ISRAEL. So you believe that the expenditure of $40 million would cover virtually everything we need to know about what went wrong and prevent other things from going wrong in the future.

Dr. CORLEY. Well, with any research you never know what you are going to find, so there may be things that would require more than that. But this is what I would judge is needed at this point.

Mr. ISRAEL. That is your benchmark. And Dr. Bement has said that you are close to the mark. And my final question to Mr. Shea—can you tell us approximately how much FEMA has expended up to this point——

Mr. SHEA. Our——

Mr. ISRAEL [continuing]. On the investigations?

Mr. SHEA. Yeah. Our investment today is about $600,000.

Mr. ISRAEL. $600,000.

Mr. SHEA. Right.

Mr. ISRAEL. And we need to get to 40 million.

Mr. SHEA. Right.

Mr. ISRAEL. Thank you, Mr. Chairman. I yield back.

Chairman BOEHLERT. Thank you very much. The Chair will now yield to Dr. Ehlers, who is going to assume the Chair momentarily, for his questioning.

Mr. EHLERS [presiding]. I never realized one could become chairman of this Committee that quickly. It is a pleasure to have you all here. And I want to pursue the line of questioning that you just heard. You—as I understand, when you say policy approval, Dr. Bement, that means you also have the authority to spend the money needed to do it. Is that correct?

Dr. BEMENT. I have no statutory authority to spend that kind of money at the present time.

Mr. EHLERS. Okay. Then the next question is, where is the money going to come from? And that—let me also say, Mr. Shea, I am going to hit you on this too. We are talking $40 million. That is not just—that is not just the study. That is also following up, as you said, Dr. Corley. And I presume by that, that means follow-up studies on determining the nature of progressive collapse, which was responsible not only for the towers collapsing, but I understand also for a good deal of the damage done in the Oklahoma City disaster as well.

Now, does your estimate of $40 million, Dr. Corley, include further studies on progressive collapse, further studies on fire damage to steel structures, and so forth, or is that not part of your recommendation?

Dr. CORLEY. Yes. That would include all of the subjects that I have mentioned, plus those that have been brought up in the other testimony.

Mr. EHLERS. Well, I personally think that is money well spent and the Nation, as a whole, would save a lot of money if that is done. The question is, where is the money going to come from. I know, Dr. Bement, because I have jurisdiction over NIST in my Subcommittee, you don't have the money to do it.

Dr. BEMENT. That is correct.

Mr. EHLERS. Now, Mr. Shea, you have a substantial amount of money, which was given as part of the money that the Congress approved last year, to deal with it. How much of your money are you dedicating to this effort, both the initial work and also the ongoing study? In other words, do you have enough money to fund the $40 million that we are talking about here?

Mr. SHEA. No. The direct answer is, we do not. The funding that was provided to us is really for the relief of victims and for rebuilding the community and to pay for police, fire, that kind of thing. The Stafford Act would not encompass these types of long-term studies. And if we were to undertake them like anybody else in the Federal Government, we would have to go through a process with the Administration to request them.

Mr. EHLERS. So you have no funding for research.

Mr. SHEA. Well, realistically, we have some small pockets of funding that relate to flood-related issues, seismic-related issues, dam safety issues, but those are all very specifically authorized kinds of things that we do. The amount of funding there is relatively small comparatively speaking.

Mr. EHLERS. And where did you get the money for this initial study that has been done?

Mr. SHEA. The initial assessment comes out of the disaster relief fund because it is, again, scope-limited. It is important to understand, the whole effort is designed to provide a basis for rebuilding with mitigation incorporated as part of that overall mitigation process, rebuilding process, so that it is part of the overall relief and recovery effort.

Mr. EHLERS. But you have asked NIST to take over the formal investigation, but you are not sending the money along with that request. Is that what you are saying?

Mr. SHEA. Well, we think it is an excellent idea to have an investigation, a longer-term investigation of these issues based on our experience in these areas. But, no, we would not send funding to go with it.

Mr. EHLERS. However, if the Congress made—passed the provision that part of that $6 billion you received could be used for that, would you send the money along with it then?

Mr. SHEA. If Congress and the Administration agreed on a principle like that, then, sure. I mean, absolutely. Yes, sir.

Mr. EHLERS. Okay. That is certainly one solution. I—Dr. Bement, as I said earlier, I know you don't have the money, and that is not quite accurate. You do have it, but it would do incredible damage to NIST if all of that money came out of your budget. And so, clearly, the money has to come from somewhere.

Dr. BEMENT. Right.

Mr. EHLERS. Is the Administration considering at all including this as part of its supplemental request to the Congress, which I understand is coming out in a week or two?

Dr. BEMENT. I believe that is a consideration. Yes. I can't say that that is the avenue they will finally decide on, but I know that they are considering that.

Mr. EHLERS. And, Mr. Shea, pinning down a little more, when you say you have no authority, are you talking about no statutory authority or no budget authority to send money at this point and demands as well?

Mr. SHEA. The—we do not have statutory authority to conduct these types of investigations. And obviously then, we wouldn't have the intended resource base associated with that.

Mr. EHLERS. And NIST has a statutory authority, but you are saying not the budget authority at this point.

Dr. BEMENT. The mechanism that is in the statute is deficient in terms of providing the funding and providing the mechanisms to get an appropriate response, technical response, on the site immediately. And——

Mr. EHLERS. So I have——

Dr. BEMENT [continuing]. We have covered that ground.

Mr. EHLERS. I have a couple of worries here. First of all, there is a lot of this going on in terms of funding, and we and the Administration have to come to some agreement on where the money is going to come from. My other concern is involving the academic community, which you see represented here and which has a very good background. The National Science Foundation actually was the first on the ground with investigators and has done this regularly in cases like this.

I am very concerned that we, as an Administration and a Congress, provide sufficient funds for NIST to do what it does so extremely well. But I think it is also important that we provide funding for the university community——

Dr. BEMENT. I agree.

Mr. EHLERS [continuing]. To participate. Now, that either would come through NSF. Or I understand, Dr. Bement, you also can give grants to——

Dr. BEMENT. Well, we will bring universities into our study and——

Mr. EHLERS. You will include that——

Dr. BEMENT [continuing]. We will fund that work. Yes.

Mr. EHLERS. And that would be part of your funding as well.

Dr. BEMENT. That is correct.

Mr. EHLERS. All right. I think we have clarified that problem, but it is clear that we have to do more work on it, otherwise we will have grand plans for grand studies and not only in finding out what happened here, but also how to prevent it in the future, both in terms of fire and progressive collapse damage. And if we are not careful—and by we, I include the Congress and the Administration—it just won't—it won't be done. So I hope that all of us in Congress will keep everyone's feet to the fire and make sure we get this job done. I——

Dr. BEMENT. Thank you.

Mr. EHLERS [continuing]. Yield back my time. Next, we call on Mr. Etheridge from North Carolina.

Mr. ETHERIDGE. Thank you, Mr. Chairman. And let me thank you and the Chairman of our Committee for having this hearing that is so important, not only to the people in New York, but the people in this country, and I think ultimately around the world, because this is—we have seen a lot of things happen. And I think it is not only important just to the families of the victims of the 9/11 tragedy, but it is important to all of us to learn as much as we can at this date about the collapse of the World Trade Center buildings.

Aside from withstanding enormous wind loads, the World Trade Center towers were also constructed to withstand sediment loads. Because the towers, as you know, I don't need to remind any of you, were built on a landfill. And it went down and they had to go down and do bedrock and all the stuff that took place. As I remember, it was about 70 feet below ground level, I think, that it wound up going down.

Although the towers were, in fact, designed to withstand being struck by an airplane, no one ever envisioned what ultimately happened on September the 11th. They weren't able to survive the effects of a direct hit with all the gasoline. And I know you have been talking about that already with the collapse of floors and the pancaking, etcetera. And I, like others, have been there and was horrified at what I saw.

In trying to comprehend how this happened, that the loads just collapsed, is there any reason to have concern on how other tall buildings are constructed in this country and the safety of the people that are occupying them? Who would like to take that on?

Mr. SHEA. Congressman, I am not an engineer, and I am probably the only person at this table that isn't an engineer, but I would say the answer to your question is, yes, there should be some concern. And I think the notion of a longer-term investigation should help answer some of those questions about whether and what we can do about that. But, again, I don't think we have the answers this afternoon.

Mr. ETHERIDGE. Anyone else?

Mr. CORBETT. Yeah. I think that the critical point here is that there are other high-rise buildings in this country and we need to understand exactly what happened at the World Trade Center and learn from it and apply it to other buildings. I mean, this is a fire—you know, planes hit the building, but it was a fire that brought it down——

Mr. ETHERIDGE. Absolutely

Mr. CORBETT [continuing]. And we need to understand that.

Dr. ASTANEH-ASL. One of the important things is that until now, structures are designed by structural engineers. Then they are passed to fire engineers to design the fireproofing, but there is no interaction. I think it is very important that for the future we come up with joint work of the fireproofing engineers as well as structural engineers. And I think the NIST plan is very good in that sense, that it will bring in fire engineers and structural engineers.

But to answer your question directly, I think, yes, we have a lot of concerns about all other tall buildings.

Mr. ETHERIDGE. Thank you. One additional question if I may, because that brings on the second question—with all the different agencies we now have looking at it, and as we go forward, because I remember in your earlier testimony, as you were talking, almost each one of you were talking about data that may have been lost because of a number of issues not having been protected, etcetera, because we have so many involved. What are we doing now to protect that data? And what are we doing to lay out a plan so that we—God forbid we should ever have something like this again—at least we have got a plan in place so that, number one, we protect the integrity of the information, but, number two, we have got a plan working to make sure that we don't have the kind of problems we have had with this one?

Mr. SHEA. Congressman, I will attempt to begin the answer to that question. The—I guess I would point out a couple of things. One is, FEMA is working with the team from the American Society of Civil Engineers to preserve whatever data is available. And that is, in fact, also being shared with the National Institute of Standards and Technology. As was testified earlier, they are receiving some of this steel that was called as part of that effort.

Further, FEMA and the National Institute of Standards and Technology have begun discussions of a preliminary mechanism by which we could do better in the future, in a Memorandum of Understanding about a quick response mechanism. But I think there is a more fundamental question here about how do we effectively coordinate all the science-based agencies in responding to events of this kind? I am not sure we have the answers to that this afternoon, but I think it is a fair issue for the Committee to address.

Dr. BEMENT. Representative Etheridge, I would answer this way—that that clearly is part of our investigation. We don't have to wait until the end of the investigation to have findings and recommendations with regard to those aspects. And we would certainly consult with this Committee very quickly once we have such a plan in hand.

Mr. ETHERIDGE. Thank you. And I—if I may, Mr. Chairman, I would encourage you to move along, to work through your associations and others, because as other buildings are being built, it seems to me to be most appropriate to work through every avenue we have to not only shore up the ones we now have, but those that are being built, for safety and for fire safety as well. Thank you. Thank you, Mr. Chairman. I yield back.

Chairman BOEHLERT [presiding]. Thank you very much. Mr. Grucci.

Mr. GRUCCI. Thank you, Mr. Chairman. And thank you for convening this hearing today. The information has been pretty helpful so far. I have just been listening to the debate going back and forth about the dollar values for the study. Is it enough? Isn't it enough? Who has it? Who doesn't have it? And I hope that we can work that out very quickly.

But, Mr. Shea—and this is not an attack against you. It was just something that I heard in your statement early on, when you indicated that it will take years to complete these studies. And I would encourage all that is in—that is going to be part of this is that, we can't wait years. There are people out there who need answers now. Not only those that are sitting in this room, but the thousands of others whose lives have been torn apart as a result of this tragedy.

In addition to those folks, I know that this Congress won't wait years. I know this Congressperson won't wait years. We want answers. We need answers. And we would hope and encourage you all to move quickly in this. Let us weed through who doesn't have and who does have the authority and let us all get on the same team to get to the end results. Because, as Mr. Etheridge said, there are buildings going up that can use the benefit of the knowledge that will come out of these—out of these hearings and come out of the study that you will do.

If you need money, I can't promise that you will get it all, but I can promise you that we are going to be here to work with you to get this thing resolved. Because, as the Chairman said, this is not an attack against you. We are all here to work together.

My question goes pretty much to trying to at least assemble in my mind what happened from what I am hearing today. In gleaning through the information that you all provided in your testimony and I, too, have had the opportunity to read it, one thing came clear to me that it wasn't the elongated fire from the fuel of the jet planes that created the extreme heat that, indeed, may have had or may not have had direct results on the tinsel strength of the steel causing the building to collapse.

Because, as I understood it, from my reading, the jet fuel probably burnt off between 10 to 15 minutes after the impact of the jet into the building. What caused the intense heat and the massive fires was that jet fuel, as a first fire, causing the rest of the floors where that jet fuel came into contact with to catch fire and desks and chairs and rugs and whatever else may have been in the building, then started to burn as the fuel. And I understand that there was a fair number of floors that were involved with that.

The question that I have is that if, indeed, it was not the jet fuel that was the main culprit, and that it did, indeed, burn itself off in a reasonable time—fast enough where it didn't affect the strength of the steel—and that the secondary fires caused the problem, why wouldn't the fire suppression system that should have been, or was in the building—I shouldn't say should have been—it was in the building—why didn't they function on the floors that may not have come into direct contact with the jet craft that may have taken out the pipes and the suppression systems? And I think—well, whoever wants to try to answer that, please do.

Dr. CORLEY. Okay. I will take the first stab at that. That it is our belief that the water source for the sprinkler system was compromised and there was no water that was supplied to the system after the planes hit—nothing above the floors that were hit.

Mr. GRUCCI. But the floors beneath where it hit would still have had water.

Dr. CORLEY. They would have had water, but there was really no fire—well, there was only a small amount of fire there. And some of those fires were controlled even with hand-held fire-fighting equipment.

Mr. GRUCCI. And so the fires that were the secondary fires, if you will, as a result of the jet fuel, were on the floors above where the plane impacted.

Dr. CORLEY. Yes. That is correct. At the floor and above.

Mr. GRUCCI. I would—why wouldn't it have—I was always under the impression, listening to the stories and reading in the papers, what you can glean from that, is that the jet fuel migrated its way down through the building, through the corridors, through the elevator shafts, through whatever orifice was in the building to allow the fuel to migrate down. How did it go up?

Dr. CORLEY. Well, to answer the first part of that question, yes, there was some fuel that went down, but those fires, based on the photos we have, did not spread widely. They—some of them were put out by people on those floors. The fire above—first of all, the plane took out parts of the floors and opened up the building, knocked out a lot of the windows, so that the fire could go up the—from floor to floor that way and there probably was damage to the floors that also allowed it to progress up through the building.

Mr. GRUCCI. And so the suppression systems then did work for the floors beneath it.

Dr. CORLEY. There was probably—well, yes. There was not a great deal of fire beneath the areas where the planes went in, as far as we can tell.

Mr. CORBETT. Just to add a couple of comments. As far as the——

Mr. GRUCCI. Yeah. If you would

Mr. CORBETT [continuing]. Suppression systems go, it is very likely that when the plane went through the building—we certainly know it took out the stairwells—and that is where the supply pipes for the sprinkler systems are located. So it just sheared right through them. So that would have allowed basically a flood of water to come out.

As far as lower incidents within the building, we do know that—actually, I have a student in one of my classes that is a security guard in Tower 1, and was there when the jet fuel came down the elevator shaft and blew off the doors and started a fire down there. I know from another person that I know that is an architect, and went through the lobby and saw the sprinkler system actually going off in the lobby and was wondering why, and I think that is probably the answer to that.

Chairman BOEHLERT. The gentleman's time has expired. The Chair would—the intention of the Chair is as follows. We have 12 minutes to go in terms of the current vote, and there is only one vote, so we will have to recess briefly. The Chair will recognize Mr. Israel for one minute to make an announcement and then Mr. Larson for his questions, and then we will temporarily recess to go over to answer the vote, and then we will be right back.

Mr. ISRAEL. Thank you, Mr. Chairman. And, Mr. Chairman, let me again thank you for your bipartisan leadership in bringing us to a focused and sensible approach to this issue. One recurring theme is what we are going to invest as a Nation in the type of evaluation that is going to improve the safety of both the public and emergency responders in the event of another building collapse.

Dr. Corley estimates a total of $40 million. Dr. Bement says that he is near the mark. NIST has asked for $2 million, or allocated $2 million. FEMA has already expended about half a million dollars. We want to support your efforts. We want to make sure that you have everything you need so that we can evaluate and make sure that this doesn't happen again.

In that vein, I am pleased to announce that under the Chairman's leadership, Congressman Weiner and I have cosigned a letter to Budget Director Mitch Daniels, asking him to provide you with all the funding that you require for the type of comprehensive evaluation that is going to make sense. Again, Chairman Boehlert has signed this letter. Congressman Weiner has signed the letter. And I would invite all of my colleagues on both sides of the aisle to cosign this with us. This is, once again, going to be an issue of budget priorities, and I can think of no more important budget priority than to spend what is needed to evaluate and make sure——

Chairman BOEHLERT. And I would encourage all of our colleagues to sign that letter.

Mr. ISRAEL. Thank you, Mr. Chairman.

Chairman BOEHLERT. Thank you very much. The Chair recognizes Mr. Larson.

Mr. LARSON. Thank you, Mr. Chairman. And let me add to the chorus of those thanking you for conducting this hearing. And let me also second the proposal of my colleague and join in the signing of this, and commend the Skyscraper Safety Campaign for their efforts here. And point out, as my colleague from Connecticut has, the number of people from Connecticut in the audience today, and specifically Monica Gabriel, who lost her husband, Richard, at the World Trade Center.

The questions that have been raised by my colleagues, I think, draw down to a specific point. I believe it was Thomas Friedman who indicated that since the—when we look at the tragedy of September the 11th, and we look at what happened, in many respects it was a failure of imagination. And a failure of imagination that evolves around a sense that sprung up an American government of stove-piping. Stove-piping amongst agencies is so much so that even, as Mr. Weiner and others have asked their questions today, the American public has to look at a specter of the right hand not knowing what the left hand is doing.

Now, obviously, there is plenty of blame, I guess, that could be going—that can go around. And our object here is not to lay blame, but to get to answers and solutions. But at the heart of my concern is one that has been raised, I think, by a number of people. And that is that since September 11, perhaps, we know more than we have, but we are no better prepared to address the concerns of the future. And we are no better prepared because of these turf battles and the stove-piping that persists.

So my question is, in general—and the President, and I believe wisely so, has appointed Tom Ridge, the Head of Homeland Security. And as we look to specific appropriations, and as we look, and has been cited here frequently, for specific statutory authority, do we need one central clearinghouse? The dominant theme amongst every group that I have spoken to since September the 11th, is the need for commonality of communication, interoperability, and the ability for onsite control.

In your estimation—and I know this is—you are at the beginning process—is that what this Nation needs to move forward and how do we? And how are you going to be successful in all the information that you are gathering if you can't overcome those hurdles? And I will start with you, Dr. Bement.

Dr. BEMENT. I think there does have to be a central authority that can go in and carry out an investigation and can sequester all the evidence that is necessary to carry out that investigation immediately after the collapse occurs or whatever the event is.

Mr. LARSON. Do you think that Mr. Ridge should be that authority? Do you think that we should have someone and—that can bring all the Federal agencies and state agencies and local municipalities to focus and bear on this issue?

Dr. BEMENT. Well, I wouldn't want to say that that would be the only way it could be done, but certainly it ought to be considered.

Mr. LARSON. Dr. Corbett.

Mr. CORBETT. It is certainly an answer to that question. I—we need it. We don't have it right now. We don't have a coordinated response to disaster investigations in my opinion.

Mr. LARSON. What would be the best place for that to reside? Would it be——

Mr. CORBETT. Well, I suggested FEMA because they have a responsibility for disaster response and mitigation, and mitigation is what we are talking about here—mitigating the future, mitigating issues that perhaps we are going to find in other high-rise buildings.

Mr. LARSON. Mr. Shea.

Mr. SHEA. My reaction is that the best way to approach this is to vest that authority and responsibility in a single Federal agency. In this case, my testimony is that would be the National Institute of Standards and Technology.

Mr. LARSON. So then—and would someone from the National Institute of Standards and Technology want to respond?

Dr. BEMENT. I think that——

Mr. LARSON. And this is what the American public sees. It is——

Dr. BEMENT. No. Let me give you a direct response to your question. I think where it comes to structural collapse and anything that brings together fire and structural collapse, and NIST would certainly be an appropriate agency to have that responsibility directly, as long as all the mechanisms are in place. And if we can set up the necessary board structure so that all the parties that might be involved, including local and state authorities, can be on the scene immediately, and that there are necessary subpoena powers in order to gather information and——

Mr. LARSON. We have a very serious problem here. And it seems to me, every time we discuss this—and there is increasing frustration in Congress at all levels—that when we talk to the bureaucracy responsible for this, we get the Abbott and Costello line of who is on first?

Chairman BOEHLERT. The gentleman——

Mr. LARSON. And it just goes on and on and on.

Chairman BOEHLERT. The gentleman's time has expired. In all fairness, I think it is very important—and this Committee prides itself on working together—it is very important to understand and appreciate that this is something unprecedented in the history of mankind. And what we are trying—there is clear authority—if there is a hurricane, if there is a flood, if there is an airplane crash, there is clear authority for various agencies to commit. This is something where we are sort of plowing new ground. And it is very important, as the testimony indicates, that we design a protocol so that we will know instantly if something, God forbid, like this ever happens again, we have got people onsite, in charge, action initiated.

With that, the Chair recognizes Ms. Morella, and she has four minutes and 40 seconds before we have to go vote.

Ms. MORELLA. Thank you. Okay. I will talk really fast.

Chairman BOEHLERT. Uh-huh.

Ms. MORELLA. Thank you, Mr. Chairman, for this hearing. And I do want to also reflect the fact that to the families of the victims who are here, I offer my condolences and prayers. And this is one of the reasons why we had this hearing. Thank you, gentlemen, for your presentations. And I know the Chairman will allow us to submit some questions to you too, because we have more questions that we haven't gotten to.

I wanted to pick up—Dr. Bement, I know you are getting a lot of questions here, and, welcome, at the helm of the National Institute of Standards and Technology. But some of the——

Dr. BEMENT. Thank you.

Ms. MORELLA [continuing]. Important research that has been mentioned here today is going to—it seems to require a large-scale testing facility. To what extent are NIST laboratories equipped to do that kind of work, to carry on that kind of work? In other words, are you going to need some additional facilities for this and, if so, what will their capabilities be and, you know, what would they—what would it cost?

Dr. BEMENT. Well, as you know, this is an unprecedented event.

Ms. MORELLA. Yeah.

Dr. BEMENT. It is probably the first time that—on this scale, structural dynamics and fire dynamics have come together to create an initiating event that created a catastrophe. That is an area where we do need to do research. We need to do research at an appropriate scale so that we can understand the fire response of building materials and building structures. And I can say that we do not have that kind of a facility at the present time.

Ms. MORELLA. So that is something that we are going to have to factor into what happens after the report, is to look at that.

Dr. BEMENT. Yes.

Ms. MORELLA. Because I certainly don't want to see cannibalization of the other research that is being done, you know, at NIST. And I know you don't either.

Dr. BEMENT. I appreciate that.

Ms. MORELLA. So, Mr. Chairman, you are going to have to look at the facility for this too after that.

Chairman BOEHLERT. The angel of NIST has spoken. Are you going to be coming back because we have to take a brief recess now?

Ms. MORELLA. I——

Chairman BOEHLERT. Because when we come back, you are—the time will be yours, Ms. Morella.

Ms. MORELLA. Well——

Chairman BOEHLERT. But we only have two minutes and 30 seconds. And unless you can run faster than me, we are going to have difficulty getting over there.

Ms. MORELLA. All right. Fine. Thank you. I will try to. If I can't, I will submit some questions.

Chairman BOEHLERT. And I should have mentioned previously——

Ms. MORELLA. Thank you.

Chairman BOEHLERT [continuing]. That after the opening statements by all the witnesses, the statement for the Skyscraper Safety Committee will be in the record for all to see and to consider. We will take a brief recess. We will get back as quickly as can. You can have a pause, a break, in the act.

[Recess]

Chairman BOEHLERT. This hearing will resume. Members are making their way back from the Floor. The Chair is pleased to recognize Ms. Sheila Jackson Lee for five minutes.

Ms. JACKSON LEE. Thank you very much, Mr. Chairman. I want to add my appreciation to you for holding this very important hearing. I don't think any of us who live in communities, regardless of whether they are urban or rural, could express ourselves in watching the tragic incidences of September 11. And to be able to find solutions, I think, is a key element to what this hearing is all about.

Having visited Ground Zero in the early stages and knowing what my New York colleagues have been through and how much they have fought so hard for finding a remedy to September 11, I think this hearing may begin to be part of the healing. And I, too, offer my deepest sympathy, and, as well, expression of concern to those who were victims of that terrible and tragic day. To the families, I expressly offer my deepest sympathy.

I realize that we have had a long hearing, but I am looking at today's New York Times article. And in reviewing this article, I am noting in particular that the first paragraph announces the adoption of new national standards for the construction of public and governmental buildings, to make them more resilient or resistant to catastrophic failures in the event of terrorist attacks. It notes that the leader of the investigation into the World Trade Center's collapse, and the director of the Federal agency that evaluates major fires and building failures, are calling for such standards.

Now, I have listened to my colleagues. I have reviewed some of the testimonies in terms of the presented testimonies. I do apologize for being at another hearing at the same time. But I want to pointedly ask the question. Based upon this article, is it true that we are calling for the adoption of such? And are you advocating for these standards to be federalized, as many of us realize that we have little input at this point?

I would also like to find out how does the present standards systems or the present system work and who is responsible for oversight and implementation. I am also aware that there are many private groups or societies of engineers and others that have a great deal of impact on the design of buildings. And they also have a great deal, with all due respect to the professions, with interfering with the creation of new standards.

So I guess if I can start with some of the representatives here, Dr. Bement, and, Dr. Corley, are we today, at this hearing, calling for new standards? Have you called for them in this hearing? And are they to be Federal standards? That would be my first. And I have two other questions and I would like to—I am looking at the light—be able to at least have them raised before the time runs out.

Dr. BEMENT. I would say that right now we don't have the technical basis for new standards. We have a compelling incident. The compelling incident has to be backed up with a technical investigation and evaluation. So we need the technical basis that will go to a new standards development.

Now, standards development and code development in this country is done by a consensus process through various code development organizations. And there are at least two organizations, the ICC, and the Federal Fire Protection Agency[1], that issues a number of model codes that are used throughout the country by local authorities to fashion their own codes for their own region.

NIST provides some of the technical basis for those model code developments, but we are, by far, not the only source of technical information that goes into the development of those codes.

Ms. JACKSON LEE. So that wouldn't be you that the New York Times is speaking of, that you were calling for new Federal standards when announcing them today.

Dr. BEMENT. That is correct.

Ms. JACKSON LEE. You believe there needs to be a consensus.

Dr. BEMENT. I believe, first of all, we need to develop the technical basis, and that is the purpose of our investigation. So we will be working very closely with the code development organizations.

Ms. JACKSON LEE. Let me ask Dr. Corley then, as my time runs out. Were you prepared to call for new Federal standards today and have—recommend those adoption of such?

Dr. CORLEY. No. I am not. It is premature to call for changes. Once the work that I have referred to that I believe needs to be done has been completed, and as it gets completed, there may, indeed, be things that come up that need to be considered by the standards-writing groups and may change the existing standards through the processes just mentioned. But it is premature at this point to pinpoint any one item and say that this is ready to be changed. And under no circumstances do I feel that the processes that are currently in place should be changed. They work well and should continue.

Ms. JACKSON LEE. Mr. Chairman, can I raise these additional questions for the record minimally, and maybe someone can give me a yes or no? I think they are quick enough to give me a yes or no.

Chairman BOEHLERT. If you can get the yes or no within the minute.

Ms. JACKSON LEE. Thank you so very much, Mr. Chairman. And, Dr. Corley, in particular, you were involved in the Oklahoma investigation, as I understand, and made several recommendations. I guess the question would be, and I imagine the families would want to hear, how quickly government can move. My question is, were those recommendations implemented? That can be a yes or a no. And then, finally, is any recommendation made for improving building codes, emergency responses, and evaluation? Are any of those being made? What are the obstacles to making changes in the codes? I think that needs to be answered today by those who have been victimized by this very tragic incident. Were any of your recommendations taken in? Yes or no?

---

[1] Upon review, Dr. Bement clarified that this was the National Fire Protection Association, and not the Federal Fire Protection Agency.

Dr. CORLEY. The ones we made were, yes.

Ms. JACKSON LEE. They were taken in.

Chairman BOEHLERT. Thank you. The lady has very skillfully——

Ms. JACKSON LEE. Thank you.

Chairman BOEHLERT. All right. The additional time is—she is——

Ms. JACKSON LEE. And I will put the other ones in writing, Mr. Chairman. Thank you for your time.

Chairman BOEHLERT. She is very adroit at doing that. And we are going to have another round. So, Sheila, don't go away. We are here to stay. Mr. Smith.

Mr. SMITH OF MICHIGAN. Mr. Chairman, and thank you for holding this hearing, and thank the witnesses for being so diligent and patient over the last 2½, 3 hours.

My first question—of course, bin Laden was a construction engineer. And I'm just wondering, Mr. Shea, Dr. Astaneh, or whoever else, I am a—as a pilot and talking to other friends that are pilots, wondered at the preciseness of that apparent accident—other pilots and I can agree that these pilots had—were very good flyers to fly at that speed and hit that target. And I am curious, to make—put it on the record, if maybe it was on purpose, hitting it at that particular height. What would have happened if the plane hit in the top two stories or down in the bottom six stories?

Dr. ASTANEH-ASL. If the planes had hit at the upper levels, top ten stories, most likely we would not have this tragedy. I feel that you would have burned floors at the top. You could rescue people underneath and then later cut those floors and have a 100-story building.

If they had hit the lower part of building, you would not have the collapse again, because the plane could not enter as intact as it did. The columns there are very strong, very thick, and most likely the plane will be shattered, as I showed in my example analysis, and the fuel will be outside.

I don't know if they did it on purpose, but they really hit the worst part where the plane could enter and cause the fire and there was enough weight above the floors that they hit to collapse it under gravity.

Mr. SMITH OF MICHIGAN. Would you agree, Mr. Shea?

Mr. SHEA. Yes. Absolutely. There is no question in my mind that—there was an attempt made on this building in 1993. It failed. They spent the next 8 years figuring out how to do it.

Mr. SMITH OF MICHIGAN. I chair the Subcommittee on Research that has oversight for the National Science Foundation. And, Dr. Corley, Dr. Bement, NSF has—well, they have done a lot, with the nanotechnology that we have developed in our research, to help search up there in those facilities. But I am wondering—it is my understanding that NSF now has eight teams out studying. And, Dr. Corley, Dr. Bement, how are the data collected by NSF and these funded researchers being utilized in both of your studies?

Dr. BEMENT. Well, I can answer that they will be fully utilized in our study. Most investigators funded by the NSF would probably show results in the open literature and they would generally make available any of their—the results of their work. We would certainly want to have the full report——

Mr. SMITH OF MICHIGAN. Well, do you have some process or some organization that you are now inquiring and utilizing that in your studies or is it just going to be—is something—is it in——

Dr. BEMENT. No. Our study will be fully inclusive. We will use all sources of expertise that are——

Mr. SMITH OF MICHIGAN. But you haven't so far.

Dr. BEMENT. We are in very close contact with NSF. And, of course, we are participating in the American Society for Civil Engineering study, the BPAT study, and I imagine that some of the results of the NSF studies are being utilized in that phase of the investigation.

Mr. SMITH OF MICHIGAN. Dr. Corley.

Dr. CORLEY. Yes. I might—if I could start by referring to bin Laden. My understanding, his degree is not in engineering and I do not have the opinion that if the—if it were studied exactly where to hit it, that he was the one that made the final decision on that. As far as——

Mr. SMITH OF MICHIGAN. And why is that?

Dr. CORLEY. His degree was not in—it is in public administration, I believe. He is not an engineer to the best of my knowledge.

Mr. SMITH OF MICHIGAN. But in terms of you would conclude that it wasn't him that made the decision——

Dr. CORLEY. I don't think he would have the knowledge to make that decision. The—in regard to your question about utilization of information, we are utilizing everything we can get our hands on. And the NSF was instrumental in putting together a workshop in December where researchers working on this did exchange information. So we were able to get some of it at that time. And we, of course, look for all the ways we can to get it.

Mr. SMITH OF MICHIGAN. Dr. Astaneh, do you agree?

Dr. ASTANEH-ASL. I wish we had more cooperation with other teams and utilize our results as well as data. So far I have done my research based on data that I have collected myself and I have not been able to have data from other teams, including drawings and other information that could be very useful to my research.

Mr. SMITH OF MICHIGAN. Will NIST be using Dr. Astaneh's steel that he collected as far as the evaluation and analysis?

Dr. BEMENT. We have it now, or at least we have the initial samples. And we have more coming. So I don't know piece by piece whether——

Mr. SMITH OF MICHIGAN. Just shortly—Dr. Astaneh, you had just——

Dr. ASTANEH-ASL. Yes. I hope that there—the studies that NIST is proposing would involve study of pieces that I have collected and others, as well as involvement from whole community of academia who are doing research.

Mr. SMITH OF MICHIGAN. Mr. Chairman, thank you. I will look forward to the second round.

Chairman BOEHLERT. Thank you very much. Dr. Bartlett.

Mr. BARTLETT. Thank you very much. Clearly, we need to understand the engineering of what happened here of this failure. I just signed on to a letter asking for additional money so that this can be properly done. I am really somewhat amazed that you were excluded from the site. Clearly, understanding what happened there, so that we could better design buildings and prevent this sort of a tragedy in the future, should have been the prime objective. I hope that you can get the information you need, even though you have been excluded from the site and still haven't got the drawings and so forth.

I would just like to ask a question about where we go from here. Clearly, the most inviting terrorist targets are where there are a lot of people closely pressed together. If it is a chemical attack, the more people that are in close confines, the better. If it is a biological attack where more people are going to be affected. If it is a bomb, the more people are going to be affected. If it is an event like this, the more people are going to be affected.

In today's world with mass communication, with computers, with teleconferencing, this information travels, what, 186,000 miles a second. It doesn't take very long to get from Manhattan to a corn field in Omaha. Help me understand why it is a good idea to build more skyscrapers that are just more inviting targets for terrorists? Yes, sir.

Dr. ASTANEH-ASL. I think it is the human spirit.

Mr. BARTLETT. If you are building them for pride of ownership, I understand that. It is the equivalent of going to the moon and I understand that. But in terms of being concerned about protection of people and fighting terrorism and so forth, I—you know, I just—I am having some problems understanding why bringing more people together in close confines and building skyscrapers, with all the communication techniques now, we—that started when we didn't have the communication capabilities we have today. I am having trouble understanding why it is a good idea to keep on building skyscrapers.

Dr. CORLEY. If I may respond briefly to that, it is my—and this is a personal opinion—the city is not a city without tall buildings. If you have all one-story buildings, all you have is urban sprawl. You have no city.

Mr. BARTLETT. Washington is not a city?

Dr. CORLEY. But Washington does have some tall buildings——

Mr. BARTLETT. Not very tall buildings.

Dr. CORLEY. So my belief is that it is appropriate to design the tall buildings. And I would also point out that it is not just tall buildings that are the target. The Pentagon was not a tall building.

Mr. BARTLETT. That is correct. And the damage inflicted by the plane that hit the Pentagon was orders of magnitude less than the planes that hit those buildings, simply because it was not a tall building, which makes my argument that I am having some trouble understanding why it is a good idea to build more tall buildings. Yes, sir.

Dr. ASTANEH-ASL. And may I add one comment? What we have done is we have gone up and up over the last century or so without looking into the fact that you cannot expand everything without limit. There is a size effect in everything, in all our engineering work, that when you get to a certain size, you have to change the concept that you are using. We have, unfortunately, added up these floors without looking at the fact that you cannot reach the upper floors for fire fighting and you cannot really protect them against airplanes and other objects. I think it does not answer your question directly and I apologize for that. But I think what we are missed—and did not pay attention is that, in our effort to build tall buildings, we have not paid attention to protecting them.

Mr. BARTLETT. I am personally uncomfortable in a building that can't be reached by the longest ladder on a ladder truck. I know that you rely on other things in those tall buildings. But, you know, I am still—you know, repeat my initial question. This is—our society has been changed. The world we live in has been changed.

And I would submit that one of the things we ought to consider is whether it is, in fact, a good idea to build these inviting terrorist targets in the future. They are a good target for biological warfare. They are good targets for chemical warfare. They are certainly good targets for bombing and this sort of thing. And I am just—you know, we just need to stop and rethink what we are doing, and is that the right thing to be doing in the future? And I would question whether building more skyscrapers is, in fact, in our national security interest in the future. Thank you very much, Mr. Chairman.

Chairman BOEHLERT. Thank you very much. And we are welcoming, as a guest in the Committee, but an interested guest, Mr. Crowley of New York.

Mr. CROWLEY. First, let me thank the Chairman for allowing me to sit on the Committee today and for holding this hearing. I come to this Committee hearing with mixed emotions because I have over 105 families who lost loved ones on September 11. And we have members of the Ashton family who are here today who lost their son, Tom, at 21 years of age. I also lost my first cousin, Battalion Chief John Moran, and I knew at least seven people intimately, very well. So I have, again, mixed emotions.

But, recognizing the need to hold these hearings, once again, I commend you, Mr. Chairman, for taking on this responsibility. I have a number of questions that I think I would address to Mr. Shea, Dr. Corley, and Dr. Bement firstly. And one, can any one of you gentlemen tell me who was in charge of amassing the steel and other debris as a result from the attack of September 11 on the WTC?

Mr. SHEA. I am not sure I understand fully your question, but——

Mr. CROWLEY. In other words, who—what entity was in charge of collecting the material?

Mr. SHEA. FEMA commissioned the Building Performance Assessment Team, and it was that team, led by Dr. Corley, that would have embraced that responsibility.

Mr. CROWLEY. Did they determine which debris would be sold off as scrap? And if not, who did?

Mr. SHEA. I will—yeah, I will defer to Dr. Corley on that.

Dr. CORLEY. No. We did not determine that. That was determined, I understand, by the City of New York. We——

Mr. CROWLEY. When did you—when did you become aware that the steel from the World Trade Center was being sold off?

Dr. CORLEY. I think it was on the order of a week or so before we arrived on site, on October the 5th, I believe it was.

Mr. CROWLEY. So they were—they—in other words, the city was selling or was disposing of material within two weeks of the actual event, or was it prior to that?

Dr. CORLEY. It may have been prior to that. I am not sure when the first decision was made on that. But I didn't find out—we didn't find out about it until then.

Mr. CROWLEY. Were you disturbed by that—by finding that out? Were you disturbed to find out that the city was actually disposing of or selling off that material?

Dr. CORLEY. We had previously indicated that we definitely wanted to see the steel and select quantities that were——

Mr. CROWLEY. Did you or did FEMA or any other entity actually ask or tell the City of New York to cease and desist from disposing of that material?

Dr. CORLEY. As far as the team is concerned, we made it known that we needed steel. And I don't have any knowledge that anyone had the authority even to ask them to cease and desist.

Mr. CROWLEY. So no one even asked them politely to stop selling what, in all likelihood, could be evidence? Dr. Astaneh.

Dr. ASTANEH-ASL. But I believe I was the first one to find out that the steel was being recycled. New York Times Reporter Jim Glanz told me two weeks after the quake—after the collapse. And I tried to contact the city and also the New York Times reporters tried to make sure we could have access to the steel to do the research. It was not happening. And I went myself—directly contacted the recycling plant and made the arrangement. Through their cooperation, I started work there and collected the steel. And later, two weeks later, I believe, the ASCE team came also and they started their work.

Mr. CROWLEY. Now, Dr. Corley, you said that no significant loss occurred, or no significant difference, I think was the word you used.

Dr. CORLEY. Yes.

Mr. CROWLEY. On any outcome that would be determined by the loss of that material.

Dr. CORLEY. That is my opinion at this point. Yes.

Mr. CROWLEY. So you don't believe that there was any material that was lost that was significant that day.

Dr. CORLEY. No. I really didn't say that. What I said was that I believe—or what I implied was that we will be able to draw supportable conclusions and analyze the building to understand what happened without the steel that has been disposed of.

Mr. CROWLEY. In my remaining time—excuse me, doctor. It is—my light is changing here. I just want to emphasize my support of what Mr. Corbett was talking about. I did not know that you were going to make the suggestion today, sir, of a commission. I was prepared to make a statement today that we should ask the President or ask Congress to initiate a commission, similar to what took place after the 1983 and '84 bombings of our embassies overseas, the Inman Commission, to determine what steps are necessary to secure the existing structures, because we can't simply flatten Manhattan or any other major city in this country. We have to deal with the problem because we have major tall structures.

I would—secondly, in the construction of future buildings and of future high-rises, suggest that they be made with the proper structure that could withstand a terrorist attack. Let me just say, and, Mr. Chairman, in closing, I am not so sure that this Subcommittee or this Committee can actually get to the bottom of this, which I think is your intent. I—although I think that your attempt is going to be admirable. I think we need to do more and let some more academics do this as well.

But I do believe that conspiracy theorists are going to have a field day with this. They are going to make the Warren Commission look like a walk in the park. And that is unfortunate not only for the Members of Congress who are trying to work on this issue, but for all the families out there that are listening very carefully to what we are talking about today, what these experts are saying. And I just think there is so much that has been lost in these last six months that we can never go back and retrieve. And that is not only unfortunate, it is borderline criminal.

Chairman BOEHLERT. Yeah.

Mr. CROWLEY. And I will yield back with that, Mr. Chairman.

Chairman BOEHLERT. Thank you. And thank you, Mr. Crowley. And the whole purpose of this hearing is to get as much information as we can so that we can be very prudent and very thorough in our analysis and make the appropriate recommendations. Let me point out, in response to your line of questioning, the decision was made by the City of New York to dispose of the material before the BPAT team was even onsite. And I understand fully what the City of New York was doing. Their first interest was the search and rescue operation and they had to get the debris out of the way. And it had a BPAT team, but on site, they would have immediately said, you know, we need this. This is evidence. We need this. This is very important, so get it out of site obviously. We don't want to hamper the research—rescue operation.

But at one time, they were even talking about dumping it into the sea to build a new reef for fish. But, in any event, it just points up to the fact that the material should have been saved. And had there been a timely response of a BPAT team, had we had a protocol in place to get people onsite, we know who is in charge and when, someone would have said that.

And, Dr. Corley, I must say this—I have never found any instance in this whole aftermath where anyone has indicated that the City of New York, which has been absolutely magnificent, was anything but cooperative. So you may not have had the authority legally to say, hey, listen, don't destroy this stuff. This is very important for evidence in our investigation. I am sure that if someone had said, in a timely manner, we would need this, we request that you save it, and you would have got the same response whether you had the authority or not. They were trying to be as cooperative as possible.

But we have to understand the whole circumstances. The world literally was collapsing around everything. And they were all in there—and everybody—and the FEMA people and the NIST people, when they got onsite, the NSF people, everybody was just trying to do everything they possibly could to tie everything together and to get to the bottom of it and to make recommendations on future actions so that it will never happen again, as much as we can prevent. And we hope and pray every day it never will happen again. So no one here is suggesting that people were intentional in some of their actions that didn't get us where we wanted to get in a timely manner.

But we have got an awful lot of questions and we are determined to continue this probe and—probe is—to continue this review to make certain we have good standing to make very specific and very timely recommendations. Who is next? I guess—I am next. All right. Well, that is good.

Mr. SHAYS. Time is up.

Chairman BOEHLERT. Yeah. Time is up. Dr. Corley, we understand that the blueprints were finally obtained when members of your team signed agreements with the Port Authority that you would not testify against it in court. And apparently that delayed getting the blueprints in a timely manner. Is this a routine procedure, and can we get copies of these agreements?

Dr. CORLEY. As far as the copies are concerned, I presume that those can be made available. Yes. As a routine, I guess I would have to say that this is the first time that I have signed one like that.

Chairman BOEHLERT. But why did it take—why did it take so long to sign these agreements and get the drawings?

Dr. CORLEY. The agreements were signed very early. The timing I would have to go back and see exactly what it was. But——

Chairman BOEHLERT. But it seems like—wasn't it something like four months later before you actually got the drawings?

Dr. CORLEY. That is roughly the way I remember it. I am not sure it is exactly four months, but it is on that order of magnitude of time. Yes. Three-and-a-half, I think.

Chairman BOEHLERT. January 8. Well——

Dr. CORLEY. Yeah. January 8 is when we finally got——

Chairman BOEHLERT. Well, that is pretty close to four months.

Dr. CORLEY. Yes.

Chairman BOEHLERT. Did FEMA help you in getting access to the drawings?

Dr. CORLEY. Yes. Very definitely they did.

Chairman BOEHLERT. And so you had to intervene. You had to step in.

Mr. SHEA. Yes.

Chairman BOEHLERT. What did you do? Can you tell us?

Mr. SHEA. We called New York City and asked them to release the documents.

Chairman BOEHLERT. And they immediately said yes?

Mr. SHEA. They did say yes.

Chairman BOEHLERT. You mean—why didn't you just call them? If they immediately said yes to you, why wouldn't they say yes to your designee?

Mr. SHEA. I——

Chairman BOEHLERT. And when did you call? You—I mean, can you get that for the record?

Mr. SHEA. Yeah. I can get it for the record. Although I—Craig, you made the call. Do you know?

Mr. WINGO. We made a number of calls, I believe, the 20th and 21st of December, Mr. Chairman.

Chairman BOEHLERT. Of December?

Mr. WINGO. Correct. Thursday or Friday.

Chairman BOEHLERT. Why so long?

Mr. WINGO. Well——

Chairman BOEHLERT. That is almost 2½ months later.

Mr. WINGO. At that particular point in time, we felt that the BPAT team was working in a diligent manner to obtain the blueprints. We recognized that there were possible concerns that the city had legally in a host of other areas. But I will tell you that once we addressed it and focused on it, they—the Port Authority released the plans on December 26.

Chairman BOEHLERT. Boy——

Mr. WINGO. Approximately four or five days after our discussions.

Chairman BOEHLERT. That is—I mean, I would hope you would have been working diligently immediately. And I—you know, and, boy, that is—2½ months. That is an awful long time. And that is lost time. In the meantime, a lot of the evidence, if you will, the steel, is being dumped someplace, nevermore to be found for one—and I am not suggesting any sinister plots.

And, as Mr. Crowley has indicated, the tabloid press could have a field day with this. We are not interested in providing fodder for them. What we are interested in are facts. Learning from this experience, recommending corrective actions, working in partnership to see that that corrective action is initiated ASAP. All right. What else do we have here?

Oh, yeah. Dr. Corley, you also mentioned in your testimony—I was amazed by this—that you had some problems getting videotapes from news organizations. Why would they have any problem with giving you videotapes?

Dr. CORLEY. Yes. We did have some problems. My understanding is that the tape that had not been played on the networks was not available to us. Anything that had been played eventually we were able to get access to, which is——

Chairman BOEHLERT. But the one that wasn't played—I mean, you had a reason for requesting it.

Dr. CORLEY. Yes. We did.

Chairman BOEHLERT. This is a very important review and investigation. And why wouldn't they—I understand that the networks didn't have some of the taped—tapes on television for all to see because they felt it was not appropriate. Is that your understanding?

Dr. CORLEY. There are more—very likely was tape like that also that they did not feel was appropriate. But my understanding was that what had not been used yet was not available to us. And I——

Chairman BOEHLERT. But so what you are suggesting to me that our TV networks were not cooperative in something critically important to the Nation.

Dr. CORLEY. I would say they—I felt that they were cooperative in many, many ways. And they did——

Chairman BOEHLERT. Yeah. I understand.

Dr. CORLEY [continuing]. Provide us with lots and lots of material.

Chairman BOEHLERT. And then I applaud them for that and that is wonderful and I think they should as a civic responsibility. But are they going to be selective in what they provide you? Are you going to have a selective investigation review and recommendations? I mean, I would think they would want to be complete. Is there some liability questions or do you—what—when you asked for something and they didn't give it to you, what was the reason they gave you for not giving it to you?

Dr. CORLEY. I really did not personally hear those reasons. I simply was told that we would only get the tapes that we got which——

Chairman BOEHLERT. Was the request in writing or was it verbal?

Dr. CORLEY. I—it certainly was verbal. And to the best of my knowledge, it was also in writing.

Chairman BOEHLERT. Would you share, for the Committee, for the record, a copy of the written request and also a copy of the written response?

Dr. CORLEY. We can find that information. Yes.

Chairman BOEHLERT. All right. Thank you. Mr. Weiner.

Mr. WEINER. Thank you, Mr. Chairman. I am troubled by what I have heard first and my suggestion—my colleague, Mr. Bartlett, that we shouldn't build up—just build left and right. Perhaps that is true, but I doubt very much there is much demand for skyscrapers in rural Maryland. But I am also surprised by the characterization of the Chairman, however well-meaning, that the city was cooperative. We just heard testimony that the city was the opposite of cooperative. That they had refused to provide basic information.

And the issue isn't when members of the panel signed a document agreeing not to sue, it is where you get off agreeing not to testify. You are public officials gathering information for the public. You don't own it. You don't have the ability to say I won't use it here. I will use it there. You will use it wherever we say you will use it. If you come before us after looking at these blueprints and you decide that the Port Authority was at fault, and you raise your right hand because the Chairman asks you to, you are going to tell us, I don't care what you sign.

The idea that—and this is a government agency, the Port Authority of New York and New Jersey. It is not a foreign planet. It is not a private company. These are—this is an organization that is funded with our taxpayer dollars, with our fees when we fly in and out of airports. The idea that they should demand that whatever information is collected should not be held against them, well, that is not, to me, being cooperative.

And let us not kid ourselves. Whenever you ask for it, Mr. Wingo, you aren't going to get it unless the New York Times ran a story on Christmas Day. All right. The truth be told, that if it weren't for the fact that attention was called to this and bright lights were shown on it, they would not have cooperated to this day—I would be surprised if you would have the blueprints that you needed.

And to give you a sense, the importance of the blueprints, so we all understand it, you know, if we are going to do an investigation of the strength and weaknesses of the trusses that firefighters speak so much about, well, you need the blueprints to find out where to even look—where do you look in the rubble.

And the idea that the city was cooperative—well, I am not so sure. You know, the two things are not mutually exclusive. Recovering someone and examining the steel that might have been laying on top of them, are not mutually exclusive. You can do that at Great Kills. You can do that on the truck before it is loaded onto the barge. You can do it on the barge.

The idea that there was some level of cooperation, I have to tell you, the anecdotal record is replete with stories of people having cameras confiscated from them, being stopped at checkpoints. You are officials of the United States Government. The idea that this should have to be a subject of a long negotiation over what information would be at your disposal, to me is most troubling.

But let me just ask one question. Mr. Shea, you got my mind spinning when you said the following. You said, you think that in 1993, after the failure of bombing of World Trade Center, they immediately went to work on some other ways to topple it. Did you?

Mr. SHEA. I am sorry?

Mr. WEINER. You said that in 1993, you believed that bin Laden and the terrorists immediately went to work on trying to figure out how to topple the building——

Mr. SHEA. Yeah.

Mr. WEINER [continuing]. Since they failed. Did you? Did you immediately go to work on that? Did you start to contemplate, well, they failed this time. Let us look at why they failed and what we can do to make sure they don't succeed next time?

Mr. SHEA. Now, Congressman, the answer is no and——

Mr. WEINER. Did anyone in the United States Government do that?

Mr. SHEA. I have no idea. I do not know.

Mr. WEINER. Mr. Corbett, as an academic, are you aware of any academic studies that were done to say, you know what, they missed, but they only missed by a few inches, or they missed by a mile? Or if they would have done this or that, it might have been cataclysmic? Has anyone—did anyone do the same type of thinking, with all of our—there is about 150 years of experience in front of us—did anyone do what bin Laden—Mr. Shea says what bid Laden probably did, which is to say, well, we struck out this time—how are we going to get it right next time? Does anyone do that in the academic world?

Mr. CORBETT. Yeah. We certainly do. There was actually a mitigation report—survey team report from FEMA, Document #984-DR-MY, that looked into the issues of the 1993 incident. I don't know what of these issues that were ever applied to the building. I know there were improvements made to the Trade Center, certainly, as far as fire protection.

Mr. WEINER. Dr. Astaneh-Asl—and I apologize for getting your name wrong.

Dr. ASTANEH-ASL. Astaneh.

Mr. WEINER. Weiner, Weiner, Astaneh, Weiner, whatever—what—are you aware, sir, of any of the recommendations that were made following 1993 on structural performance that contemplated a large fire in the building?

Dr. ASTANEH-ASL. No. But that is because I am not in fire engineering.

Mr. WEINER. No. No. I understand. I just thought in—perhaps in your research.

Dr. ASTANEH-ASL. But I can comment that after tragedy of Oklahoma City, a large number of research and activity was conducted. I did, myself, quite a lot of studies of how you can prevent tragedies like that and GSA funded and recently finished the development of that.

Mr. WEINER. You know, but it is—if you will forgive me, my time is just about expired. But my concern is, the World Trade Center—you didn't need to have an imagination. You can see they came at us in the World Trade Center and they tried to do something. During the trial it was clear—in all the testimony—what they were trying to do was bring down the World Trade Center. You didn't need to think that far out of the box for someone to sit down at their computer and say, wow, now that we know what their target is, let us figure out whether or not we are safe from those targets and what steps you could take, not just stopping cars from getting into the garage, but figuring out you—because we might have——

Dr. ASTANEH-ASL. Yes.

Mr. WEINER [continuing]. Stumbled upon information that might have been helpful. Thank you, Mr. Chairman.

Dr. ASTANEH-ASL. Yes. There was some activity on——

Chairman BOEHLERT. Thank you, Mr.—thank you, Mr. Weiner. Mr. Shays. And I would ask the audience to refrain from any expressions of support or disapproval of somebody's statement. This is a very serious, very important, hearing. And our witnesses are resources for the Committee and they are giving us their best counsel and best recollection. And we are trying all to be involved in something worthy of our best effort. Thank you. Mr. Shays.

Mr. SHAYS. Thank you, Mr. Chairman. Perhaps, with a few number of members, we could even have a third round. I want to say that one thing I am pretty convinced of since September 11, is there is enough blame to go around for all of us. I mean, we can say what you all should have done and we can say what we should have done. We have been at war with terrorism for 20 years and acted like we didn't know it.

And if we had listed to what some of the terrorists were saying in their native tongues, we probably would have known about 9/11. So I am pretty convinced that we all need to look at ourselves as well.

I am pretty convinced, though, that what I have heard today leaves me less comfortable than before I started the hearing. And it started with Mr. Weiner's question of who is in charge, and I thought I knew. And then I asked one of the staff who I should ask my question to, and they told me the person I thought I should ask, I shouldn't. I was going to ask you, Dr. Bement——

Dr. BEMENT. Bement.

Mr. SHAYS [continuing]. What you were—Bement?

Dr. BEMENT. Bement.

Mr. SHAYS. Bement. Dr. Bement, I was going to ask you what you were going to do on all these things. And I realize it is not you—it is Dr. Corley that is really doing this investigation. You just want the investigation, but you have $2 million and would like more, and so on. And you want the authority maybe in the future to do hearing—do these investigations. So I have two sides to this. What?

Dr. BEMENT. Let me correct you. We have actually done some elements of this investigation.

Mr. SHAYS. Right.

Dr. BEMENT. And we have done some computer modeling. We have modeled the fire. We have modeled the——

Mr. SHAY. Right. But the overall investigation is not your responsibility. It is Dr. Corley's. Correct?

Dr. BEMENT. I—no. I would—I——

Dr. CORLEY. Yeah.

Mr. SHAY. No. I can't have a no and a yes. I mean, I thought this was—yeah.

Dr. CORLEY. Yes. Mr. Shays, I did raise my hand that as far as the actual field work and——

Mr. SHAYS. Okay.

Dr. CORLEY [continuing]. The collection of data, I am in charge of that for the——

Mr. SHAYS. Right.

Dr. CORLEY [continuing]. FEMA ASCE team.

Mr. SHAYS. Well, in the five minutes that is slowly leaving me, I have two sets of questions. One is a set of questions that some of the families who are here would like to know the answer to. And then I would like to know—and I would like to maybe ask this question for my third round—I want to specifically know before I leave here exactly what you would be recommending to Congress. And, Mr. Shea, every time they call on you, I jump. But, Mr.—only because——

Mr. SHEA. Well, I will jump for you.

Mr. SHAYS. Yeah, okay. The bottom line is, I would like to know specifically what you want us to do, what powers you think we need to do so this chairman can recommend to others if it doesn't all go through his Committee—specifically what we should do so there is no question as to who has authority and things happen right away and people have the statutory power and the ability to demand information and to hold people accountable. So that you can start to think about. I want a list, before we leave, on that.

But the—for the families—they—is this investigation, Dr. Corley, looking at evacuation procedures? I want a simple question—answer—no, or, yes, if it is——

Dr. CORLEY. Yes.

Mr. SHAYS. Okay. Is it—is it going to report on the sprinkler systems not working?

Dr. CORLEY. We will mention that and recommend things to be done.

Mr. SHAYS. Access to roof eliminated. In other words, people couldn't get to the rooftop because it was blocked off, whereas the last time they could, so some went up rather than down. Will you be looking at why those doors were locked?

Dr. CORLEY. No.

Mr. SHAYS. Reports of stairway doors being locked? Will you be looking at that?

Dr. CORLEY. That will be something in our recommendations. We are not specifically doing it here.

Mr. SHAYS. Well, will you be checking to see if they were, in fact, locked? Will you be interviewing witnesses?

Dr. CORLEY. No. That will be future work.

Mr. SHAYS. Overall safety procedures, i.e., fire drills, fire inspections, and so on—will you be making any comment about that?

Dr. CORLEY. Again, that is future work.

Mr. SHAYS. Lack of communication between the Port Authority and the rescue personnel?

Dr. CORLEY. Same answer, future work.

Mr. SHAYS. Okay.

Dr. CORLEY. We are not directly addressing that.

Mr. SHAYS. Is NIST going to do——

Dr. CORLEY. Yes.

Dr. BEMENT. Yes.

Mr. SHAYS. Okay.

Dr. BEMENT. All those things that you mentioned and more. And let me say that——

Mr. SHAYS. And by future, now future?

Dr. BEMENT. I am talking about the investigation that we have been talking about——

Mr. SHAYS. Right. Okay.

Dr. BEMENT [continuing]. During the hearing. This broader investigation that we are taking responsibility for, we will address all those issues.

Mr. SHAYS. Okay.

Dr. BEMENT. And we will start with the investigation that the American Society for Civil Engineers——

Mr. SHAYS. So we will have some answers to these questions.

Dr. BEMENT. You will have answers to those questions.

Mr. SHAYS. Doors were locked. And so some of what——

Dr. BEMENT. That is right.

Mr. SHAYS [continuing]. Dr. Corley responded as to future, that is basically——

Dr. BEMENT. We will take a much more deliberate approach to getting answers to all those questions.

Mr. SHAYS. Okay. Okay. And, Mr. Shea, I am going to come back my second round to ask you and others what specific powers you—we need, who should have those powers, and so on. Thank you. Thank you, Mr. Chairman.

Chairman BOEHLERT. Thank you. It seems to me, Mr. Shea, that BPAT did not get the aggressive support it needed from the minute this whole thing started from FEMA. I mean, I can't understand, for example, on the blueprints, why it took until December—December—no, it was actually January 8 before they finally got them. Wasn't it?

Mr. SHEA. Uh-huh. Yeah.

Chairman BOEHLERT. I mean, wasn't that one of the first requests you made? And I understand you didn't drop everything on September 11. I mean, we were all shocked. And, once again, let me stress, rightly, everybody was focused on search and rescue—everybody.

But it seems to me that fairly soon thereafter—and I am talking about hours, not days—some action should have been launched to do things like protect the steel and the evidence, to gather the blueprints, to recognize that this was a disaster of monumental proportions, and it is going to require a most comprehensive investigation. And it doesn't appear that there was that instant response in the manner that I would like to have seen from FEMA. Can you address that?

Mr. SHEA. Well, Mr. Chairman, I will do the best I can. I——

Chairman BOEHLERT. Well, let me let you think a little bit more, because I wanted to get to Dr. Corley's statement. One of the things he talks about in his testimony—"When studying damaged structures, it is important to understand the physical nature of the original structure as soon as possible"—as soon as possible. And then later on he said, "The delay in the receipt of the plans hindered the team's ability to confirm their understanding of the buildings." Delay—delay—and so they couldn't do the job that we expected them to do as rapidly as we wanted them to do. So, please talk to me a little bit about that, if you will.

Mr. SHEA. Mr. Chairman, my reaction to your question is, frankly, I agree with you. There were many things that in hindsight now that we would have done different differently. But I have to also say this—it wasn't just a matter of being distracted by other things. We weren't, in fact, trying to react to the entire World Trade Center event. The agency was—had all its resources pulling——

Chairman BOEHLERT. Well, you were stretched to the limit. I understand that.

Mr. SHEA. I—there was no question in my mind that that was the case. And while, again, we would have liked to have done things better, part of the rationale here is this. My belief is—and this is somewhat in response to Congressman Shay's question as well—we started out this hearing by making a recommendation that the National Institute of Standards and Technology be the appropriate agency to carry this type of work out. Part of the reason, quite frankly, is because of the size and technical capability of our agency, I frankly, think they won't have the same kinds of issues confronting them should they address an issue of this kind in the future. So that is my recommendation. I mean, I am serious on that. I believe——

Chairman BOEHLERT. So——

Mr. SHEA [continuing]. That from a good government standpoint, it makes much more sense to have an agency not directly involved in the immediate response activity involved in this kind of an issue.

Chairman BOEHLERT. So we learn from experience, and the experience in this unfortunate incident leads us to conclude that we were not as timely and as forceful as we should have been in some areas, including requesting that the debris be segregated and preserved for future investigation. Because, as Dr. Corbett points out, it is very important. Dr. Astaneh points out—Dr. Corley—they all agree it is very important. And that the blueprints—I think you have to be scratching your head and yourself wondering why it took four months to get those blueprints to begin.

I can only conclude that we have never been through something like this before and, boy, I hope we never go through it again. And we better darn well move forward very aggressively in developing a protocol that says if—and we hope it never happens—but if something like this ever happens again, we have got people onsite right away. We know who is in charge. We have got video teams and we have got oral history teams and we have got—bringing in Dr. Corley and his people right away. And we are getting—and we know what questions to ask and who to ask of them. And it is sorry that we had to learn the hard way. But I hope we have learned an awful lot from this experience. And, well, with that, let me go to Mr. Crowley.

Mr. CROWLEY. Thank you, Mr. Chairman, once again. Dr. Astaneh, are you involved officially in the investigation of the World Trade Center disaster—attack?

Dr. ASTANEH-ASL. Well, my involvement—I am not involved with the ASCE team at all.

Mr. CROWLEY. And, Dr. Corbett, are you?

Mr. CORBETT. No. I am not involved officially.

Mr. CROWLEY. Okay. Dr. Corley, are any academics involved in the investigation?

Dr. CORLEY. Yes. Forty percent of our core team is from the academic community.

Mr. CROWLEY. And is—Dr. Corley, is your—is ASCE in charge of obtaining oral testimony or oral evidence?

Dr. CORLEY. We are—I would not say we are in charge of that, but we are obtaining some oral—well, oral descriptions of what people saw, did, and what happened——

Mr. CROWLEY. I am assuming you know what you are looking for. In other words, the questions that would need to be asked from a technical term would have to come from either yourself or someone like yourself who knows what they are asking. Right?

Dr. CORLEY. Absolutely. We know what we are looking for in the areas that this study concerns.

Mr. CROWLEY. And is that ongoing?

Dr. CORLEY. Yes. It is.

Mr. CROWLEY. And when did it begin? When were you getting that—when did you start collecting that oral or—testimony?

Dr. CORLEY. With—we started collecting some of that before we were onsite. We were in contact—people contacted us and we collected some of that information even before we got onsite. And we have continued to collect it when we can find people that have information we are after.

Mr. CROWLEY. Let me just ask this question, Mr. Corley—Dr. Corley. You mentioned future studies——

Dr. CORLEY. Yes.

Mr. CROWLEY [continuing]. As opposed to the present study. Can you just clarify, for me—I mean, for the people in this room, what you mean by that?

Dr. CORLEY. Yes. What I am referring to is that when we finish our report and it becomes—or is transmitted in the month of April, I am talking about whatever happens after that point.

Mr. CROWLEY. Are you running into any other roadblocks in terms of not only the city or the state or any other entity, in terms of obtaining information that you request?

Dr. CORLEY. Well, as—in any project like this, there are difficulties in collecting information because people don't know where it is, things like that. And we have the normal number of problems like that in this study.

Mr. CROWLEY. I mean, I am talking specifically about government agencies. Are you still running into roadblocks, like the one you experienced in January in which you had to sign a document saying you would not testify in court?

Dr. CORLEY. I would not be able to name you any additional ones than things that have been discussed today, but there—if I thought about it, I might come up with something. But I don't think of anything right now.

Mr. CROWLEY. Dr. Bement, you said earlier that—well, I don't know if you said this or not—but there apparently seems to be a problem in terms of being able to gather information and in terms of working cooperatively with local and city government. Is that correct?

Dr. BEMENT. No. We haven't run into any of those problems as yet. As a matter of fact, one of the most valuable sources of oral history will be from the New York Fire Department in the recounting of the events from the firefighters themselves. And we——

Mr. CROWLEY. Would you describe the events of early January as a problem?

Dr. BEMENT. And tell me what events you are referring to.

Mr. CROWLEY. In terms of Dr. Corley having to sign a document stating that he would not testify in court against the Port Authority or the city, I am assuming.

Dr. BEMENT. It certainly was an impediment to his study. I consider it to be a problem.

Mr. CROWLEY. I thank you and I yield back the balance of my time.

Chairman BOEHLERT. Thank you. Let us see—well, Mr. Shays.

Mr. SHAYS. Thank you, Mr. Chairman. Mr. Chairman, to my—to the witnesses, I would like to know what powers are needed specifically and who should have these powers to do an investigation almost in with the—well, I don't want to prejudice this—to do a thorough investigation? Mr. Shea, do you want to start?

Mr. SHEA. From our perspective in FEMA, I think that we, again, would want to say that we feel the National Institute of Standards and Technology is the appropriate agency. They have some existing authority. But I think this Committee, through this hearing today, has already identified some areas where they would need some additional authority.

Mr. SHAYS. Okay. So they should have the authority.

Mr. SHEA. Yes.

Mr. SHAYS. And then what particular powers should they have or should it have?

Mr. SHEA. Well, again, I would defer to Dr. Bement on that. But my belief is they obviously want to have access to sites, ready access to the design and construction drawings, things of this nature.

Mr. SHAYS. Dr. Bement.

Dr. BEMENT. Yes. I think, first of all, we would have to have a reserve funding mechanism so that we could bring parties on board. We would have to have something like a National Construction Studies Board where people——

Mr. SHAYS. And let me ask you, in the National Constructions Board, was this what looked at L'Ambiance in Bridgeport when we lost 18 people?

Dr. BEMENT. No. The——

Mr. SHAYS. Well, who did that work? That was—was that——

Dr. BEMENT. There is a National Transportation Studies Board that has the authorities and the first response responsibility.

Mr. SHAYS. Is someone—can you consult with anyone who can tell you who did L'Ambiance? No. I don't——

Mr. SUNDER. We did the study and OSHA changed the mandatory standards——

Mr. SHAYS. Excuse me, sir. I don't know—you need to identify yourself.

Chairman BOEHLERT. Identify yourself for the record, please.

Mr. SUNDER. I am Shyam Sunder. I am the Chief of the Structures Division at NIST.

Mr. SHAYS. Okay. I am sorry. And what was the answer?

Mr. SUNDER. And we did the study and OSHA changed the mandatory standards as a result of that.

Mr. SHAYS. Okay. Thank you very much. So you all did the study. I interrupted you. So you talked about the construction board and then—I am sorry, Dr. Bement.

Dr. BEMENT. Well, we are all talking about a faster response. And what that means is there has to be an organization in place that is empowered to immediately arrive on the scene that has sufficient authority to gather evidence that has subpoena power and that has the adequate funding mechanisms to carry on whatever investigation at whatever scale is needed—whatever is necessary.

I would also add, it is almost a no-brainer that there is no reason why building blueprints have to be in paper or vellum format. They could be on electronic format, in which case everyone could have the zip file. I mean, the firefighters could have their disk and a lot of people could have that disk.

Mr. SHAYS. But there would some we wouldn't want to have that information. Yeah. Right. Anything else?

Dr. BEMENT. No.

Mr. SHAYS. To the gentleman that just came, could I invite you just to come back and just tell me with L'Ambiance was there subpoena power? Was there other powers that accompanied that investigation?

Mr. SUNDER. No. We have typically not required that because the statute, as you know, says that any work we do is not—cannot be used in a court of law. And also, Federal employees can't serve as expert witnesses in general. So——

Mr. SHAYS. And what was the purpose for not being in a court of law? What is the motivation for that?

Mr. SUNDER. Usually we draw a distinction between structural failures and failures after natural disasters. In the case of structural failures, there is usually litigation problems between different parties. And since we are doing a technical study, focusing on the technical issues, we don't go in to the issues of finding fault and negligence in our work.

Mr. SHAYS. Thank you. Dr. Bement, if you would help me a second, wouldn't you need also the authority to look at malfeasance, just a failure to—for someone doing their job—probably—wouldn't it have to involve not just structural issues, but other issues as well?

Dr. BEMENT. Again, our role is to do technical studies and not——

Mr. SHAYS. No. But that is maybe—suggests that maybe you should only play a part. And, Mr. Shea, that there needs to be some other organization that looks at this from a holistic point of view. I mean, if doors were locked, if processes aren't followed that should be, it would suggest to me that NIST wouldn't be——

Dr. BEMENT. Well, I think there would be many, many organizations that would get involved at that stage in——

Mr. SHAYS. No. But that is what we are trying to avoid.

Dr. BEMENT [continuing]. Providing evidence.

Mr. SHAYS. We are trying to avoid if everybody is responsible, nobody is. We want one board ultimately or one group ultimately, it seems to me, to have the authority to look at every aspect of why something happened that shouldn't have happened. And so that really argues for you being a part of this, but somebody else having a greater role.

Dr. BEMENT. Well, I think the point here is that at what point do you want to get beyond conducting an independent, open, public, unbiased study that is inclusive to going to the other extreme of developing evidence and fault-finding and——

Mr. SHAYS. Yeah. But when NTSB looks at something, they look at pilot performance besides looking at structural issues. They look at a lot of issues. They don't just look at one part. So I mean, I understand where you are coming from. It may make sense for you to focus on just structural issues, but ultimately this Committee needs to make a recommendation that I think that is one that——

Dr. BEMENT. I agree with that.

Mr. SHAYS. Okay.

Dr. BEMENT. Yes. I agree with that.

Mr. SHAYS. Okay. Thank you.

Chairman BOEHLERT. Thank you, Mr. Shays. You know, as I mentioned in my opening statement, this investigation seems to be unusually concerned with secrecy. Can you explain that to me, Mr. Shea, why that is so, and why—we know, for example, that the Port Authority did not take this approach after the '93 bombing. And what is the nature of the confidentiality agreements that BPAT participants were asked to sign?

Mr. SHEA. The nature is that the team members won't disclose publicly the conversations and opinions that are going on during the course of their deliberations. This is primarily intended to protect the scientific integrity of the process. That is——

Chairman BOEHLERT. You are saying—but that—Dr. Corley, didn't you say that is unusual?

Dr. CORLEY. My comment was that I don't recall when I have signed an agreement like that in the past.

Chairman BOEHLERT. Mr. Shea, do you recall requesting such agreements in previous instances?

Mr. SHEA. Yeah. Our confidentiality agreements are standard fare as part of the way that we have historically done these Building Performance Assessment Teams.

Chairman BOEHLERT. But why all the secrecy? I mean, we didn't have a spokesperson for FEMA out talking to the public? I mean, obviously, when you have got an ongoing investigation, you don't give chapter or verse——

Mr. SHEA. Right.

Chairman BOEHLERT [continuing]. Along the way. But it seems that there was undue secrecy and people were just hungry for more information. Do you think I am unfair in characterizing the situation as one involving undue secrecy?

Mr. SHEA. I guess I am a little taken aback by that, Mr. Chairman. I—my opinion of the situation is that what we were attempting to do was provide an environment for scientists and technical engineers and academicians to come to judgments—and this often involves opinions—and give them an opportunity to bring their opinions forward in an unbiased way and free from any undue influence from outside parties.

Chairman BOEHLERT. Yeah. But do you have a spokesperson to deal with the rest of the world, other than the—Dr. Corley and his team, the BPAT team, and those who are involved internally in the process? I mean, there are a lot of questions understandably from the rest of the world.

Mr. SHEA. Right.

Chairman BOEHLERT. But was there a spokesperson to address those questions on behalf of FEMA?

Mr. SHEA. Well, as far as I understand, if we were asked questions that we did try and respond to them. Now, I am not aware of any circumstance in which we were unresponsive to somebody. In fact, I was interviewed as part of this process. I did engage in a conference call with some people who had some concerns about our issue. And I——

Chairman BOEHLERT. I am just reading from the SOP here, Standard Operating Procedures——

Mr. SHEA. Right.

Chairman BOEHLERT [continuing]. Of March 2000, Building Performance Assessment Team Program. "A BPAT media advisor's liaison is selected by the DFO public information officer to act as a liaison between the BPAT and media relations staff and the DFO and the media. All media contacts are referred to the media affairs liaison." So if I—if my office called up or just John Q. Citizen called up on the 17th of October and said, who is your media affairs liaison, who would you have referred?

Mr. SHEA. Well, that would have been somebody in our disaster field office in New York City. Frankly, I am sorry, I don't have a name to give you right now.

Chairman BOEHLERT. Okay. I don't expect you to know the names of all your employees.

Mr. SHEA. But, in fact, there was somebody there. There was a media liaison who would deal with issues of that nature.

Chairman BOEHLERT. Yeah. Well, counsel just points out to me that in some instances leaks to the media sort of backfired, because that is not a desirable way to do business—have leaks.

Mr. SHEA. I couldn't agree more, Mr. Chairman.

Chairman BOEHLERT. But leaks only come about when there are people who are sort of frustrated in many instances that information isn't getting out to the public, and so they do it in bits and dribbles, and sometimes it compromises an ongoing investigation or works contrary to the desired result in terms of the ongoing investigation. And that is why I happen to believe public information is very important. And I would have thought that maybe a higher level person than just a person on the site in a field office, not having a great deal of authority and not being able to speak with authority for FEMA—that is really an awesome responsibility to put on someone like that.

Mr. SHEA. I don't disagree with you. I—in those circumstances, I—my anticipation is that the field office would have brought that up to Washington and that they would have involved myself or Mr. Wingo or others in the response to any of those issues.

Chairman BOEHLERT. Thank you. Mr. Weiner.

Mr. WEINER. Thank you, Mr. Chairman. First, let me begin by offering my apologies to you, Mr. Chairman, and to members of the panel if I got a little excited and loud earlier. Being from New York, we sometimes don't modulate our voices and——

Chairman BOEHLERT. I want you to know, Mr. Weiner, I also am from New York and I am proud of it.

Mr. WEINER. And I also, by no means, mean to imply that any of the members of the panel are responsible for these lapses. I believe you are cogs in a badly flawed—not to the extent that there are any cogs there—that you are cogs in a very flawed machine and a bad apparatus. And let me make that clear. But I think what we are seeing increasingly from both the Chairman's previous questions and others throughout the day is that the model you should be looking at is the NTSB.

The NTSB would be absurd—borderline ludicrous—for them to go to American Airlines and say, please let us see the diagram of your 767, please. We promise that if we find out that fibercarbons had weakened the tail, we won't tell anybody. It is mind-boggling. It is silly. I don't see any reason why the motis operandi should be any different from examining a building.

The NTSB has made a—has—did about a dozen or so briefings in the first five or six days. Sometimes they said, you know what, we can't tell you stuff because we just don't know it. As a matter of fact, you know, I had dozens of conversations with the head of the NTSB and I always commend her. I said, you know, the temptation must be to say, well, maybe it is this or maybe it is that, and they don't do that. And—but what they do do, is they do give regular updates. They let reporters throw the questions. They let members of the—of Congress know—they let the families know, we are going to be giving an update. And, as things are discounted or ruled in or ruled out, they let you know.

And the final thing that they do is they come out with a report. And by the time the report comes out, there is such credibility imbued in that document, that instantly airlines start reacting, the

FAA starts reacting, and we, as citizens, start saying, I am glad they go to the bottom of that. The theory that I heard on day one turned out not to be exactly right.

So the easiest and best answer to give to the Mr. Chairman's—and to the Chairman's last series of questions was, you know what, we are going to start giving an update to you, the public, to members of the press, to you Members of Congress every so often. Even if we don't have all the answers, we are going to stand in front of you. We are going to clarify the chain of command. We are going to have the people there, the experts who are going to answer the questions.

Can—I don't know who to ask anymore, but can you assure that you will do that in the months to come? Say that, well, if we don't have a report in the next 6 months, we will come back and maybe not give it to you in Congress, but we will have regular briefings at the NIST headquarters on how things are going.

Dr. BEMENT. Sir, yes. I can assure you that that will happen.

Mr. WEINER. Terrific. And let me just ask one other substantive thing, and as you proceed with your investigation. A couple of things that have come up—one has come up from the oral history given by the firefighters about the problems with communication. Part of it, sadly, was a reflection of 1993. They found there were problems with repeaters in the buildings that allow the radios to work. If one of the things that you could look at is ways to design into buildings a black box type of apparatus to allow the infrastructure of fire fighting to remain intact. To allow—you know, it is the old joke—you know they always recover the black boxes. Why don't they make the plane out of the black box materials so they can recover everybody.

Dr. BEMENT. Yes. And I am just delighted for you to bring that up because that is in our '03 budget request.

Mr. WEINER. Okay. What—but if you can look at that. And a second issue that has come up repeatedly, as I have spoken to the families—you know, something that unifies the families of the victims, almost to a person, is they were on the higher floors. If you can take a look at the idea of building into high rises is a place for a helicopter to land. Figure, I know what—all right, we need to have antenna and the like. Figuring out ways, as you design buildings, to think about the people who are on the Rotunda floors and thing about the ones that are not. And even if it is not, as Mr. Bartlett, perhaps, you know, would like us to take any building that is over six floors and chop them off and put them next to each other——

Dr. BEMENT. Right.

Mr. WEINER. If we can start thinking about the real world experiences of firefighters, that I don't care—you know, these guys were on the 50-something floor on their way up. We have witnesses who were talking about firefighters carrying enough gear to make up my body weight going up while people were coming down.

If we can think about this as not just an academic exercise—if we can think about ways to design buildings and retrofit buildings to think about the men and women who are going to be called in, in the worst possible case scenario. That doesn't mean tear the buildings down. But figure out a way to include in the infrastructure ways—who knows—I mean, I think it was—I don't know—it was Mr. Corbett or Mr. Shea who talked about how the wing cut through the——

Dr. BEMENT. Yes.

Mr. WEINER [continuing]. Pipe that carried the water. Maybe there is no way to avoid that. But I can tell you one thing—that, you know, there was only nominal thought given to what would happen if there was a fire up there. You know, to be honest with you——

Dr. BEMENT. Right.

Mr. WEINER [continuing]. I don't know of anyone—even, you know, you can put a standpipe on the 103rd floor. If you are not thinking about how someone on the 103rd floor is going to talk to the base downstairs, what is the point? So if you can think of that as well, and make that part of your research——

Dr. BEMENT. Mr. Weiner, we are in violent agreement on that point and we will carry that out as a key part of our investigation without doubt.

Mr. WEINER. I thank you. And let me reiterate my thank you for you, Mr. Chairman.

Chairman BOEHLERT. Thank you very much, Mr. Weiner, and, Mr. Shays. You two have been magnificent. You have been here all day. And it is obvious—it should be obvious to everyone in the audience that this isn't the first time they have been introduced to the subject. A lot of preparation goes into a hearing like this, a lot of discussions. And I really thank you for your diligence and your active participation.

And I want to clear up something for the record, Dr. Corley, because you said—just I want to make sure I understand it correctly—that shortly after September 11, you signed a confidentiality agreement, and you said you hadn't signed one like that before. Which confidentiality agreement were you referring to, the one from the Port Authority or the one from FEMA, or both?

Dr. CORLEY. I was referring to the one from the Port Authority.

Chairman BOEHLERT. So that is—an SOP, as Mr. Shea had indicated, the type of agreement you signed with FEMA.

Dr. CORLEY. Yes. I think that agreement——

Chairman BOEHLERT. Standard.

Dr. CORLEY. That is a standard agreement I had signed——

Chairman BOEHLERT. Yeah.

Dr. CORLEY [continuing]. Before.

Chairman BOEHLERT. I mean, it didn't sound out of line when he mentioned that to me.

Dr. CORLEY. Yeah.

Chairman BOEHLERT. So—but I wanted to make sure the record was clear.

Dr. CORLEY. Yeah. I am sorry if that—if I confused you.

Chairman BOEHLERT. No. No.

Mr. WINGO. Mr. Chairman, if I could, that was a standard agreement in the Oklahoma City report as well.

Chairman BOEHLERT. Sure. I understand.

Mr. WINGO. Yes, sir.

Chairman BOEHLERT. But I just wanted to make sure for the record that we got that there.

Mr. WINGO. And for the past 20 or 30 or 40 BPATs——

Chairman BOEHLERT. Well, look, I think we have learned a lot of things this afternoon—some things that raised concerns and that underscore some of the points I made right at the beginning.

First, right now, there are no clear lines of authority as to who in the Federal Government is to conduct an investigation of a building failure. No one is in charge. No one is sure what powers the Federal Government can exercise. No one is sure of the scope of an investigation, and that has to be fixed right away. And I see a lot of nodding of heads from the Panel, and I appreciate that.

We need an enhanced disaster investigation protocol in place—thank you, Dr. Corbett—so that from minute one, someone will assume a recognized leadership role. Someone has to be in charge or no one is. And having no one in charge is unacceptable.

Some of it can be fixed by the Federal agencies, and I understand that handing the ball from FEMA to NIST, which I think is logical and makes sense, but some of it has to be fixed by those of us up here in the Congress with legislation. And we are going to be looking for very specific proposals.

For starters, we have to know right now who is in charge in the instant case. Second, NIST needs to move forward with its more extended work on the lessons of the collapse. We need to see that NIST has the authority and—and this is essential—the money to move ahead. And we are not talking about nickels and dimes. Money should not, and will not, be an obstacle if this Committee has anything to say about it—to a thorough and timely investigation and recommendations. But NIST is going to have to present a more detailed plan on exactly what it will spend its money on and when.

Dr. BEMENT. Now, Mr. Chairman, we can provide more detail for the record than what you have received so far. But the——

Chairman BOEHLERT. And we are doing that—one—a lot of questions have been asked. One question that hasn't been asked directly of you. You have had 14 different pronunciations of your name today. Would you pronounce it for the Committee so that we will have——

Dr. BEMENT. Well, Mr. Chairman, I have eight children and they all pronounce it differently also. It is Bement.

Chairman BOEHLERT. Bement. Thank you.

Dr. BEMENT. That is the official version.

Chairman BOEHLERT. Thank you. And let the record show that. I want to emphasize again that correcting these deficiencies will not only help in this case, but will help us learn from future events regardless of whether they are caused by nature or by man. This Committee is committed to following up on today's hearing to ensure that the confusion and uncertainty we have brought to light today does not persist into the future.

With that, let me thank the very patient panel, my colleagues up here who have given so much of their time and talent, and to all of you witnesses. You will be hearing further from us with written submissions, and we ask that you give us a timely written response. With that, if I can find the gavel, I will adjourn this hearing.

[Whereupon, at 3:57 p.m., the Committee was adjourned.]

Appendix 1:

ADDITIONAL MATERIAL FOR THE RECORD

Federal Emergency Management Agency
Washington, D.C. 20472

FEB 4 2002

Dr. Arden L. Bement, Jr.
Director
National Institute of Standards and Technology
100 Bureau Drive Stop 100
Gaithersburg, MD 20899-1000

Dear Dr. Bement:

On behalf of the Federal Emergency Management Agency (FEMA), we would like to express our support for an independent, technical investigation of the building and fire safety issues related to the World Trade Center (WTC) disaster by the National Institute of Standards and Technology (NIST). FEMA believes that NIST is the appropriate organization to conduct the investigation given its extensive experience in this arena and in consideration of NIST's specific, unique legislative authorities to conduct structural and fire investigations.

As you know, NIST complied with statutory requirements and briefed New York City officials on January 10, 2002, on your prospective plan for the WTC investigation. We understand that this proposal received an overwhelmingly positive reception by key New York City officials.

The United States Fire Administration (USFA) will assist NIST in its analysis and FEMA will continue to manage the ongoing recovery for the WTC in coordination with the appropriate local jurisdictions. FEMA will also incorporate any findings from your studies into the recovery process, as appropriate.

FEMA commends you on this initiative and stands ready to support NIST wherever possible.

Sincerely,

R Paulison
David Paulison
Administrator
US Fire Administration

Robert F. Shea
Acting Administrator
Federal Insurance and Mitigation Administration

Cc: Joe Picciano, FEMA Region II
Ken Holden, NYCDDC

Office of Emergency Management, City of New York

February 22, 2002

Dr. Arden L. Bement, Jr.
Director
National Institute of Standards and Technology
100 Bureau Drive Stop 100
Gaithersburg, MD 20899-1000

Dear Dr. Bement,

On January 10, 2002, members of my staff attended a meeting conducted by Dr. S. Shyam Sunder, Chief of the Structures Division of your office. During this meeting Dr. Sunder gave a briefing on the National Institutes of Standards and Technology (NIST), its Building and Fire Research Laboratory, and the comprehensive public-private program planned in response to the events of September 11, 2001. He also shared preliminary plans for the technical investigation, including the use of an independent technical review panel composed of leading practitioners and academic experts to guide the investigation.

I believe NIST is the appropriate organization to conduct this investigation to create new technical and/or scientific knowledge. The New York City Office of Emergency Management (OEM) stands ready to support NIST in this effort and will participate to the extent we are able.

I look forward to collaborating with NIST and believe that the findings and recommendations of this work will be extremely valuable to the building and fire safety communities and to the future safety and well being of the American public.

To coordinate activities with my office, please contact MaryAnn Marrocolo by telephone (718-244-4835) or e-mail (mmarroco@oem.nyc.gov).

Sincerely,

Richard J. Sheirer
Commissioner

ASCE
American Society of Civil Engineers

Washington Office
1015 15th Street, N.W., Suite 600
Washington, D.C. 20005-2605
(202) 789-2200
Fax: (202) 289-6797
Web: http://www.asce.org

November 15, 2001

The Honorable Donald Evans
Secretary of Commerce
14th Street & Constitution Avenue, NW
Washington, DC 20230

Dear Mr. Secretary:

On behalf of the 125,000 members of the American Society of Civil Engineers (ASCE), I would like to thank you for the assistance of the National Institute of Standards and Technology's (NIST) Building and Fire Research Laboratory (BFRL). BFRL has been a tremendous help in ASCE's efforts to investigate the tragic events of September 11.

In response to these tragic events, ASCE has mobilized a coalition of private sector organizations and is working with NIST to develop a multifaceted, public-private disaster response plan. We have already established civil engineering study teams under ASCE's disaster response procedure, which has been in place for more than a decade. This was the fifth time the procedure has been used to establish study teams in 2001. A similar team examined the Murrah Federal Office Building in Oklahoma City after the 1995 bombing. The ASCE teams are gathering data on the catastrophic failures at the World Trade Center and the extensive damage to the Pentagon.

The events of September 11 were a wake-up call to the nation. There is an urgent and critical national need to determine the lessons to be learned from these events; disseminate immediate guidance and tools to assess and reduce vulnerability; and develop and implement standards, codes, and practices to improve the future safety and security of major buildings and facilities.

NIST, through BFRL, is in a unique position to play a leadership role in our national response. As the only federal laboratory dedicated to building and fire research, BFRL should be a leader in assessing and addressing the vulnerability of the nation's buildings and physical infrastructure. The public-private response program that has been established with significant NIST leadership, and partially funded, identifies three high priority needs:

- Structural fire protection, including probable technical cause, methods for fire resistance determination, fire safety retrofit and design of structures, mitigation of progressive collapse, and fire protective coatings.

- Human behavior, emergency response and mobility, including occupant behavior and emergency response, simulation/re-creation tools to assess and mitigate vulnerability of occupants and responders, emergency mobility technologies, and guidelines and equipment standards for fire and emergency responders.

- Building vulnerability reduction, including standard information models for simulation and re-creation of threat scenarios, guidelines and advanced technologies to reduce the vulnerability of buildings to chemical, biological, and radiological attacks, and tools to evaluate the cost-effectiveness of strategies to manage terrorist risks.

The required work will be accomplished with NIST lead or significant participation, and/or done in the private sector or academia with NIST support.

We urge you to provide NIST with $16 million in one-time supplemental funding for FY 2002 and a budget of $12 million per year for FY 2003 and beyond to fund this critical and urgent public-private initiative vital to our public safety and health. The private and public sectors have already committed partial funds and in-kind support to the program but those resources fall well short of what is needed.

We also urge you to provide NIST with an additional $10 million to expand and modify its Large Fire Facility to enable structural testing under fire conditions. Such a research capability does not exist in the United States and is critical to develop the advanced test methods, predictive tools, and performance standards. In the interim, the program will partner with the national research laboratories in Canada and the UK that can meet immediate needs.

The work proposed under this public-private program should be completed within an accelerated time frame, so that broadly accepted solutions are available to industry for rapid implementation. The outputs of this initiative will include immediate analyses and recommendations followed by preliminary guidance and tools and, finally, improved standards, technology, and practices. Work on all three fronts must get started now to meet this timetable.

Thank you for the opportunity to bring this matter to your attention. We are, of course, available to meet with you and your staff at any time to discuss the challenges ahead. Please do not hesitate to contact Brian Pallasch of our Washington Office at (202) 789-2200 with questions.

Sincerely yours,

H. Gerard Schwartz, Ph.D., P.E.
President

NFPA
NFPA® INTERNATIONAL
1 Batterymarch Park, Quincy, MA 02269-9101 USA
Phone: +1 (617) 770-3000 *Fax:* +1 (617) 770-0700 www.nfpa.org

George D. Miller
President and Chief Executive Officer

November 28, 2001

The Honorable Donald L. Evans
Secretary
US Department of Commerce
Herbert C. Hoover Building
Washington, DC 20230

Dear Secretary Evans:

As Americans, we were all shocked and outraged by the tragic events of September 11, 2001. NFPA received many messages of solidarity from our 75,000 plus members worldwide.

As the leading developer of fire and life safety codes and standards for the built environment, and occupational safety and health standards for the Nation's first responders as well as fire safety messages for the general public, NFPA immediately put in place an action plan to provide essential life safety information to the general public, building owners and managers and the Nation's first responders. This was done through both the national media and the NFPA website.

In addition, NFPA joined forces with the FEMA/ASCE led coalition to evaluate the building performance of both the World Trade Center and the Pentagon. NFPA is also a member of the Council on Tall Buildings and the Urban Habitat panel of experts established to evaluate high-rise building design in light of the terrorist attacks of September 11th.

After the first terrorist attack on the World Trade Center in 1993, NFPA conducted a major fire investigation and issued a comprehensive report. In addition, NFPA in conjunction with the National Research Council of Canada and NIST conducted a major human behavior study of survivors to assess occupant behavior in the resulting evacuation. As a result of the September 11th terrorist attack on the World Trade Center, NFPA is proposing a research project to study the human behavior of building occupants during this evacuation and a research project to look at the short and long-term effects of this incident on the public's perception of the safety of high-rise buildings. As you can see, numerous responses are underway to address many of the technical questions raised by the September 11th attack.

What is needed, however, to complete these efforts and coordinate the varied investigations and research projects is a public/private partnership with the Department of Commerce, specifically the National Institute of Standards and Technology (NIST) Building and Fire Research Laboratory.

We believe that NIST through its Building and Fire Research Laboratory is uniquely positioned to partner with the private sector in this effort because of its measurements and standards mission and its extensive expertise and experience in major failure and disaster investigations. NIST staff members serve on and provide leadership to relevant national technical and standards committees including numerous NFPA committees. They also provide leadership for major interagency efforts such as the NSTC Subcommittee on Construction and Building and the Interagency Committee on Seismic Safety in Construction.

NIST has well established working relationship with the private sector and with other Federal Agencies including the Federal Emergency Management Agency (FEMA) and the US Army Corps of Engineers (USACE). It is already participating in the World Trade Center and Pentagon expert teams and providing technical assistance to FEMA and the Corps. Further, NIST has specific legislative and executive authorities that support such activities under the Federal Response Plan, the NIST Act, the Fire Prevention and Control Act, and the National Earthquake Hazards Reduction Program Reauthorization Act. Finally, NIST – a non-regulatory agency – is recognized for its technical competence, thoroughness, credibility and impartiality.

It is vitally important that the various investigations, studies and research projects be completed within an accelerated time frame so that broadly accepted solutions are available to industry for rapid implementation. Immediate analyses and recommendations should be delivered in 6-9 months preliminary guidance and tools in 12-18 months, and improved standards, technology and tools in about three years. Work on all three fronts must get started now to meet this timetable.

This effort is needed to achieve the following critical and urgent outcomes and impacts:

- Tools to assess the vulnerability of existing building stock.
- Improved national codes, standards and practices for cost-effective retrofit of existing buildings.
- Enhanced future public safety – via reduced loss of life and injuries.
- Reduced future property losses – through engineered fire safety and collapse mitigation.
- Enhanced security of critical facilities and transportation systems.
- Future viability of tall buildings.

While many private sector organizations like NFPA, ASCE and others are commiting funds to begin a number of these efforts, the resources of our mostly non-profit organizations are limited. Many of the critical projects underway and proposed will fall far short of their intended goal without significant additional federal funding.

We estimate that $15 to $20 million of additional funding will be needed immediately and a like amount the following year to develop and implement these urgent and critically needed standards, technology and tools that are vital to public safety and health. The private sector will contribute in-kind support to this national effort but those resources fall well short of what is needed.

We urge you to direct NIST to lead and manage a coordinated national effort, and provide it with the additional resources to deliver the urgent and critically needed standards, technology and practices to improve the future safety and security of the Nation's major buildings and facilities.

Sincerely,

George D. Miller

George D. Miller
President and CEO

cc: Attached List

Copies Sent to:

The Honorable Tom Ridge
Director
Office of Homeland Security

The Honorable Mitchell E. Daniels
Director
Office of Management and Budget

Senator Robert C. Byrd
Chairman, Committee on Appropriations
United States Senate

Senator Ted Stevens
Ranking Member, Committee on Appropriations
United States Senate

Senator Ernest F. Hollings
Chairman, Subcommittee on Commerce, Justice, State, and the Judiciary
Committee on Appropriations
United States Senate

Senator Judd Gregg
Ranking Member, Subcommittee on Commerce, Justice, State, and the Judiciary
Committee on Appropriations
United States Senate

Senator John McCain
Ranking Member, Committee on Commerce, Science and Transportation
United States Senate

Senator Ron Wyden
Chairman, Subcommittee on Science, Technology, and Space
Committee on Commerce, Science and Transportation
United States Senate

Senator George Allen
Ranking Member, Subcommittee on Science, Technology, and Space
Committee on Commerce, Science and Transportation
United States Senate

The Honorable C.W. Bill Young
Chairman, Committee on Appropriations
United States House of Representatives

The Honorable David Obey
Ranking Member, Committee on Appropriations
United States House of Representatives

The Honorable Frank R. Wolf
Chairman, Subcommittee on Commerce, Justice, State, and the Judiciary
Committee on Appropriations
United States House of Representatives

The Honorable Jose E. Serrano
Ranking Member, Subcommittee on Commerce, Justice, State, and the Judiciary
Committee on Appropriations
United States House of Representatives

The Honorable Sherwood L. Boehlert
Chairman, Committee on Science
United States House of Representatives

The Honorable Ralph M. Hall
Ranking Member, Committee on Science
United States House of Representatives

The Honorable Vernon J. Ehlers
Chairman, Subcommittee on Environment, Technology, and Standards
Committee on Science
United States House of Representatives

The Honorable James A. Barcia
Ranking Member, Subcommittee on Environment, Technology, and Standards
Committee on Science
United States House of Representatives

The Honorable Paul S. Sarbanes
United States Senate

The Honorable Barbara A. Mikulski
Member, Subcommittee on Commerce, Justice, State, and the Judiciary
Committee on Appropriations
United States Senate

The Honorable Constance A. Morella
Committee on Science
United States House of Representatives

The Honorable Charles Schumer
United States Senate

The Honorable Hillary Rodham Clinton
United States Senate

The Honorable Jerrald Nadler
United States House of Representatives

Council
on
Tall Buildings
and
Urban Habitat

Chairman
Ron Klemencic
Skilling Ward Magnusson Barkshire
Seattle, USA

Executive Director
David M. Moola, Esq.
Lehigh University
Bethlehem, USA

Vice Chairmen
Africa
Syd Parsons

Australia
Henry J. Cowan, Ph.D

Europe
Ryszard M. Kowalczyk, Ph.D

Middle East
Sabah Al Rayes, Ph.D

North America
Joseph P. Colaco, Ph.D

Northern Asia
Prof. Fu-Dong Dai

South America
Edison Musa

Southern Asia
Kenneth Yeang, Ph.D

Vice Chairman at Large
M. Ridzuan Salleh, Ph.D

Director Emeritus
Lynn S. Beedle, Ph.D

November 19, 2001

Hon. Donald Evans
Secretary of Commerce
14th Street & Constitution Avenue, NW
Washington, DC 20230

Dear Mr. Secretary:

I write to you on behalf of the Council on Tall Buildings and Urban Habitat (the "Council") and in support of a public-private program to address the tragic events of September 11 developed with leadership from the National Institute of Standards and Technology (NIST), particularly their Building and Fire Research Laboratory (BRFL). The Council is a leading multi-disciplinary international organization designed to facilitate exchanges among those involved in all aspects of the planning, design, construction, operation and security of the urban environment including tall buildings. Our Chairman, Ron Klemencic, is President of the firm of Skilling Ward Magnusson Barkshire, the successor to the structural engineering firm that designed the World Trade Center. Our members are deeply concerned with the events of the past two months and quickly responded by assembling a task force that met in Chicago on October 15 to analyze and make recommendations in the wake of the tragedies. We strongly support this effort of NIST and are willing to take a leadership role in this project.

The dramatic collapse of the World Trade Center buildings and parts of the Pentagon building, and the resulting loss of life and injuries in buildings occupied by the public and in everyday use, have underscored the urgent and critical national need to establish the probable technical causes of the collapses, disseminate immediate guidance and tools to assess and reduce vulnerability, and develop and implement standards, technology, and practices to improve the future safety and security of major buildings and facilities, including critical physical infrastructure.

A public-private program has already been established, and partially funded, to derive the lessons to be learned from the September 11 events and to produce the tools needed by owners of buildings and facilities, architects, engineers and contractors, as well as emergency responders to assure that future risks are greatly reduced. The Council, along with a coalition of other leading organizations, has been working with NIST to develop a public-private response plan.

The coordinated public-private response plan identifies three high priority needs:

- Structural fire protection, including the need to establish the probable technical cause, national strategy for fire resistance determination, fire safety retrofit and design of structures, mitigation of progressive collapse, and improved fire resistance coatings;
- Human behavior, emergency response and mobility, including occupant behavior and emergency response, simulation/re-creation tools to assess and mitigate vulnerability of occupants and responders, emergency mobility technologies, and guidelines for fire and emergency responders; and

- Building vulnerability reduction, including standard information models for simulation and re-creation of threat scenarios, guidelines and tools to reduce the vulnerability of buildings to chemical, biological, and radiological attacks, and tools to evaluate the cost-effectiveness of strategies to manage terrorist risks.

The required work will be accomplished with NIST lead or significant participation, and/or done in the private sector or academia with NIST support.

We urge you to provide NIST with $16 million in one-time supplemental Federal funding for FY2002 and a budget of $12 million per year for FY 2003 and beyond to fund this critical and urgent public-private initiative vital to public safety and health. The private and public sectors have already committed partial funds and in-kind support to the program but those resources fall well short of what is needed.

We also urge you to provide NIST with an additional $10 million to expand and modify its Large Facility to enable structural testing under fire conditions. Such a research capability does not exist in the United States and is critical to develop the advanced test methods, predictive tools, and performance standards. In the interim, we will partner with the national research laboratories in Canada and the U.K. that can meet some of our immediate needs.

The work proposed under this public-private program must be completed within a highly accelerated time frame so that broadly accepted solutions are available to industry for rapid implementation. The outputs of this initiative will include immediate analyses and recommendations, followed by preliminary guidance and tools, and, finally, improved standards, technology, and practices. Work on all three fronts must get started now to meet this timetable.

The program is expected to achieve the following outcomes and impacts:

- Rapid dissemination of operational guidance for building owners and emergency responders and tools to assess the vulnerability of existing building stock.
- Improved national codes, standards, and practices for cost-effective retrofit of existing buildings and design of new buildings.
- Enhanced future public safety – via reduced loss of life and injuries
- Reduced future property losses – through engineered fire safety and collapse mitigation.
- Enhanced security of critical physical infrastructure.
- Enhanced future viability of tall buildings.

On behalf of the Council, I urge you to direct NIST to lead and manage a coordinated national program, and provide it with the additional resources, to deliver the urgent and critically needed standards, guidance, and practices to improve the future safety and security of the nation's major buildings and facilities.

I am available to meet with you and can arrange to provide additional information if that will help you in reaching a positive decision on this important national program.

Sincerely,

David M. Maola

David M. Maola
Executive Director

cc: Hon. Tom Ridge
Hon. Mitchell E. Daniels

THE AMERICAN INSTITUTE OF ARCHITECTS

Norman L. Koonce, FAIA
Executive Vice President/
Chief Executive Officer

November 27, 2001

The Honorable Donald Evans
Secretary of Commerce
14th Street & Constitutional Avenue, NW
Washington, DC 20230

Dear Mr. Secretary:

The 70,000 members of The American Institute of Architects (AIA) share with the rest of the nation great sadness over the loss of life (including a few of our members) in the tragic events surrounding the terrorist attacks on the World Trade Center. Since those events on September 11 we have shifted our emphasis from the immediate consequences of the devastation to long-term design considerations ranging from high-rise construction to building security through design.

We have joined with an eight-member coalition of private sector organizations and the professional community to respond to these tragic events. Our coalition is working with the National Institute of Science and Technology (NIST) to develop a multifaceted, public-private disaster response plan. The events of September 11 were a wake-up call to the nation. There is an urgent and critical national need to derive the lessons to be learned from these events, disseminate immediate guidance and tools to assess and reduce vulnerability, and develop and implement standards, codes, and best practices to improve the future safety and security of major buildings and their occupants.

NIST, through their Building and Fire Research Laboratories (BFRL), is in a unique position to play a leadership role in our national response. As the only federal laboratory dedicated to building and fire research, BFRL should be a leader in assessing and addressing the vulnerability of the nation's buildings and physical infrastructure including the following subjects of special interest to our members:

- Structural fire protection: including probable technical cause, methods for fire resistance determination, fire safety retrofit and design of structures, mitigation of progressive collapse, and fire protective coatings.

- Building vulnerability reduction, including standard information models for simulation and re-creation of threat scenarios, guidelines and advanced technologies to reduce the vulnerability of buildings to chemical, biological, and radiological attacks, and tools to evaluate the cost-effectiveness of strategies to manage terrorist risks.

1735 New York Avenue, NW
Washington, DC 20006-5292
Telephone 202.626.7310
Facsimile 202.626.7426
E-mail kooncen@aiamail.aia.org

- Human behavior, emergency response and mobility, including occupant behavior and emergency response, simulation/recreation tools to assess and mitigate vulnerability of occupants and responders, emergency mobility technologies, guidelines and equipment standards for fire and emergency responders, and preferred paths of ingress and egress for emergency responders and occupants respectively.

- A National Construction and Infrastructure Forum, through which facility owners and contractors together with design professionals deliver and disseminate results of research into ongoing construction projects and practice.

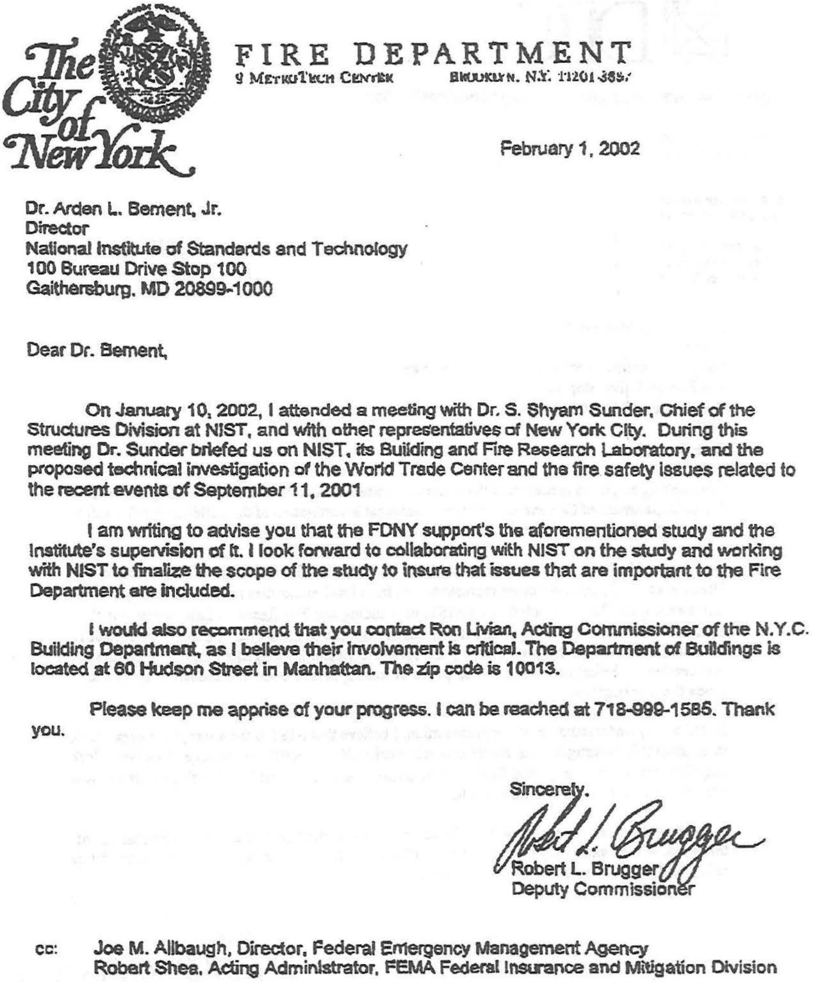
- Establish a National Construction Safety Board, whose functions would include identifying probable technical cause when national disasters occur, identifying issues for consideration in practice standards and codes, and production of technically sound, archival public documents.

We request you to encourage NIST to work with the private sector coalition to develop the critically needed standards, technology, and practice guides needed for the future security of the nation's buildings and facilities. We further ask you to arrange for Congress and the Administration to provide the needed appropriations for the NIST Building and Fire Research Laboratories to carry out these important activities, either through the FY 2003-Budget request or through any Emergency Supplemental Appropriation.

Thank you for the opportunity to present this request to you. We at the AIA are, of course, available to meet with you or any staff you may designate to discuss these matters. Please do not hesitate to contact me at 202.626.7310 or Mr. James C. Dinegar, COO of the AIA, at 202.626.7301 for any additional assistance we can provide.

Sincerely yours,

Norman L. Koonce, FAIA
Executive Vice President/CEO



The City of New York
FIRE DEPARTMENT
9 MetroTech Center Brooklyn, N.Y. 11201-3857

February 1, 2002

Dr. Arden L. Bement, Jr.
Director
National Institute of Standards and Technology
100 Bureau Drive Stop 100
Gaithersburg, MD 20899-1000

Dear Dr. Bement,

On January 10, 2002, I attended a meeting with Dr. S. Shyam Sunder, Chief of the Structures Division at NIST, and with other representatives of New York City. During this meeting Dr. Sunder briefed us on NIST, its Building and Fire Research Laboratory, and the proposed technical investigation of the World Trade Center and the fire safety issues related to the recent events of September 11, 2001

I am writing to advise you that the FDNY support's the aforementioned study and the Institute's supervision of it. I look forward to collaborating with NIST on the study and working with NIST to finalize the scope of the study to insure that issues that are important to the Fire Department are included.

I would also recommend that you contact Ron Livian, Acting Commissioner of the N.Y.C. Building Department, as I believe their involvement is critical. The Department of Buildings is located at 60 Hudson Street in Manhattan. The zip code is 10013.

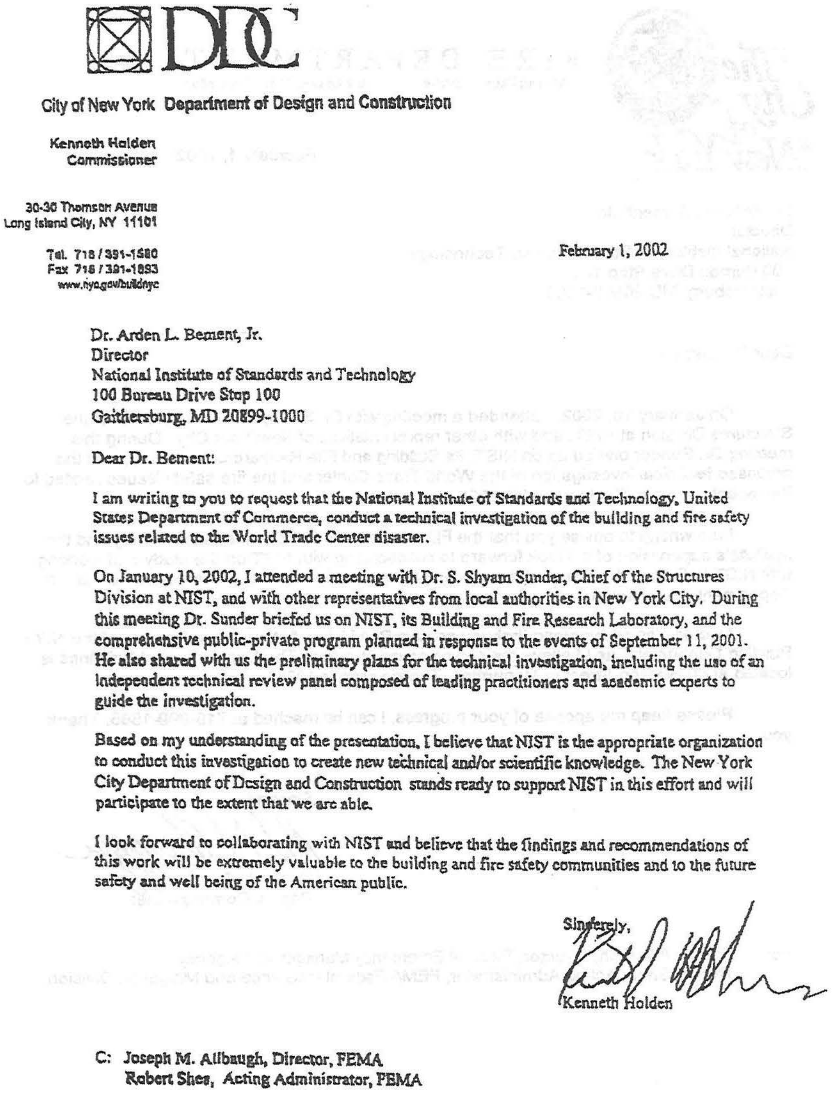
Please keep me apprise of your progress. I can be reached at 718-999-1585. Thank you.

Sincerely,

Robert L. Brugger

Robert L. Brugger
Deputy Commissioner

cc: Joe M. Allbaugh, Director, Federal Emergency Management Agency
Robert Shea, Acting Administrator, FEMA Federal Insurance and Mitigation Division



City of New York Department of Design and Construction

Kenneth Holden
Commissioner

30-30 Thomson Avenue
Long Island City, NY 11101

Tel. 718/391-1580
Fax 718/391-1893
www.nyc.gov/buildnyc

February 1, 2002

Dr. Arden L. Bement, Jr.
Director
National Institute of Standards and Technology
100 Bureau Drive Stop 100
Gaithersburg, MD 20899-1000

Dear Dr. Bement:

I am writing to you to request that the National Institute of Standards and Technology, United States Department of Commerce, conduct a technical investigation of the building and fire safety issues related to the World Trade Center disaster.

On January 10, 2002, I attended a meeting with Dr. S. Shyam Sunder, Chief of the Structures Division at NIST, and with other representatives from local authorities in New York City. During this meeting Dr. Sunder briefed us on NIST, its Building and Fire Research Laboratory, and the comprehensive public-private program planned in response to the events of September 11, 2001. He also shared with us the preliminary plans for the technical investigation, including the use of an independent technical review panel composed of leading practitioners and academic experts to guide the investigation.

Based on my understanding of the presentation, I believe that NIST is the appropriate organization to conduct this investigation to create new technical and/or scientific knowledge. The New York City Department of Design and Construction stands ready to support NIST in this effort and will participate to the extent that we are able.

I look forward to collaborating with NIST and believe that the findings and recommendations of this work will be extremely valuable to the building and fire safety communities and to the future safety and well being of the American public.

Sincerely,

Kenneth Holden

C: Joseph M. Allbaugh, Director, FEMA
Robert Shea, Acting Administrator, FEMA

THE PORT AUTHORITY OF NY & NJ

FRANCIS J. LOMBARDI
CHIEF ENGINEER
ENGINEERING DEPARTMENT

PORT AUTHORITY TECHNICAL CENTER
241 ERIE STREET, ROOM 230
JERSEY CITY, NJ 07310

(201) 216-2579

DIRECTOR'S OFFICE
NIST

2002 JAN 28 P 2:13

January 24, 2002

Dr. Arden L. Bement, Jr.
Director
National Institute of Standards and Technology
100 Bureau Drive Stop 100
Gaithersburg, MD 20899-1000

Dear Dr. Bement:

As requested, I am writing to you to express our support of the National Institute of Standards and Technology, United States Department of Commerce, in its effort to conduct a technical investigation of the building and fire safety issues related to the World Trade Center disaster.

On January 10, 2002, three of our key staff attended a meeting with Dr. S. Shyam Sunder, Chief of the Structures Division at NIST, and with other representatives from local authorities in New York City. During this meeting Dr. Sunder briefed us on NIST, its Building and Fire Research Laboratory, and the comprehensive public-private program planned in response to the events of September 11, 2001. He also shared with us the preliminary plans for the technical investigation, including the use of an independent technical review panel composed of leading practitioners and academic experts to guide the investigation.

Based on my understanding of the presentation, I believe that NIST is the appropriate federal agency to conduct this investigation to create new technical and/or scientific knowledge. The Port Authority of NY & NJ will assist NIST in this effort and will participate to the extent that we are able. *It is our understanding that no part of any report resulting from such investigation shall be submitted as evidence or used in any suit or action for damages arising out of any matter mentioned in the report. Furthermore, anyone working on this investigation will not be able to act as an expert witness*. Please confirm that our understanding of the above is accurate.

I believe that the findings and recommendations of this work will be extremely valuable to the building and fire safety communities and to the future safety and well being of the American public.

Sincerely,

Francis J. Lombardi, P.E.
Chief Engineer

cc: Joe M. Allbaugh, Director, Federal Emergency Management Agency
Robert Shea, Acting Administrator, FEMA Federal Insurance and Mitigation Division

HERBERT S. SAFFIR, *Consulting Engineers* / 350 Sevilla Avenue, Suite 108 Coral Gables, Florida 33134 / Tel. (305) 444-2611

January 2, 2002

Honorable Bob Graham
U. S. Senator
524 Hart Senate Office Building
Washington, D.C. 20510

Dear Senator Graham:

In ongoing studies of the World Trade Center building collapses, I recommend that the National Institute of Standards and Technology be brought into a more active role. NIST has prepared excellent investigations of failed structures in the past, and I believe that their agency could provide a valuable service to the public in making a study of the W.T.C. collapse.

Sincerely

Herbert S. Saffir

Herbert S. Saffir, P.E., Hon.M.ASCE

bc: Dr. Arden Bement
Director, NIST

DIRECTOR'S OFFICE
NIST
2002 JAN 22 P 2:42

U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE
SUITE 2320 RAYBURN HOUSE OFFICE BUILDING
WASHINGTON, DC 20515-6301
(202) 225-6371
TTY: (202) 226-4410
http://www.house.gov/science/welcome.htm

March 6, 2002

Mr. Mitchell E. Daniels, Jr.
Director, Office of Management and Budget
Old Executive Office Building
Washington, D.C. 20501

Dear Mr. Daniels:

We are writing to you as a result of today's House Science Committee hearing on the collapse of the World Trade Center buildings. There was unanimity among the witnesses on the need for a comprehensive assessment and research agenda to address evacuation procedures, emergency response, and structural analysis of the site's buildings. The goal of such a study would be to improve the safety of both the public and the emergency responders in the event of another building collapse.

We understand that the National Institute of Standards and Technology (NIST) has submitted a proposal for a comprehensive follow-on study. Dr. Arden Bement, NIST Director, stated at the hearing that NIST had received policy approval for such an initiative. However, we are concerned that NIST does not have the financial resources to implement its plan. Although NIST has allocated $2 million for its efforts, the Federal Emergency Management Agency's (FEMA) Building Performance Assessment Team (BPAT) has estimated that $40 million would be required to fund a comprehensive study of an event of this magnitude and complexity. We urge you to provide NIST with the funding required. The NIST proposal is fully consistent with the Administration's focus on Homeland Security and would benefit all Americans.

We have also been troubled by accounts that the BPAT did not have immediate access to the World Trade Center site. As a result, structural steel artifacts were destroyed that may have been important to the investigation. BPAT's access to architectural drawings critical to its investigation was also delayed. NIST or FEMA should have investigative authority (akin to the National Transportation Safety Board) to ensure that similar problems do not arise again.

We look forward to your response regarding funding for NIST's proposed activities and your views on vesting FEMA or NIST with authority to allow them to fully fulfill their duties.

Sincerely,

SHERWOOD L. BOEHLERT
Chairman

ANTHONY WEINER
Member of Congress

STEVE ISRAEL
Member of Congress

Mr. Mitchell E. Daniels, Jr.
Page Two

Member of Congress

Member of Congress

Member of Congress

Member of Congress

Member of Congress

Member of Congress

Connie Morella
Member of Congress

Member of Congress

Member of Congress

Member of Congress

STATEMENT OF THE SKYSCRAPER SAFETY CAMPAIGN: A Project of Parents and Families of Firefighters and World Trade Center Victims by Sally Regenhard, Chairperson

for entry into the record of the Committee on Science, U.S.House of Representatives "Learning from 9/11: Understanding the Collapse of the World Trade Center," March 6, 2002, Room 2318, Rayburn House Office Building

It is a sad reflection of the status quo that we as mothers, wives, relatives and friends of those lost in the tragic events of September 11 can make no definitive judgment on the Building Performance Assessment (BPA) of the structural failure of World Trade Center One and Two, the Twin Towers. As the Science Committee has pointed out in its charter for these hearings, the BPA Team has operated in great secrecy, accountable apparently to no one. As a result, it is not just what the BPA Team has found out that we do not know, although conclusions have apparently been reached. We do not even know what this Building Performance "Assessment" was designed to find out and the means by which it was to be done.

We are very grateful to the House of Representatives Science Committee for calling these hearings as part of its efforts to get answers to such questions. But it seems incredible to us that they had to be called in the first place.

Despite the secrecy, we do believe there is enough evidence to conclude that "the assessment" of the collapse of the Twin Towers of the World Trade Center has been deeply flawed and inadequate. We believe there is evidence that it has been flawed in conception, execution and thus possibly conclusion. Let us say at once that we do not believe this is a reflection on the individuals involved, some of who are among the most qualified and experienced experts in their field. Rather we believe it is a product of the lack of resources, authority and mandate afforded the BPA Team and the obstructionist attitude of some of those with the ability to facilitate their work. Two cases in point are the City of New York, which signed agreements to sell and recycle the steel that formed the vast bulk of the debris at Ground Zero without even consulting BPA Team members and the Port Authority, the owner of the Twin Towers, which refused despite repeated appeals, to hand over the structural drawings and other vital data to the Team until nearly four months after the disaster.

We ask the members of the Science Committee and the American public as a whole to consider these simple facts.

The collapse of the Twin Towers caused the biggest loss of life in a single incident on U.S. soil since the Civil War. Their collapse constituted the first failures of high-rise protected steel structures in history. Not a single structural engineer, including those working for the firm that built the Twin Towers and those working in the Fire Department of New York, seems to have anticipated their collapse, even when those individuals saw the extent of the fires raging in the buildings. The Twin Towers were designed to withstand the impact of the largest passenger jets of their day, a Boeing 707, not appreciably smaller than the Boeing 767s that the terrorists flew into them. Congress has voted more than $60 billion to mitigate the effects of the September 11 attacks.

Now we ask you to consider these conflicting facts.

The structural and fire engineering response is not even an investigation, it is a "study," the assumption being presumably that despite the scale and suddenness of the failures and despite the fact that the impact of a large passenger jet had been a design parameter for the Twin Towers, there is nothing to investigate. There are no known terms of reference or instructions making it impossible to judge the work of the BPA Team or the means by which they reached their conclusions. The experts, even the five who form the core of a bigger group of about 25, have been unpaid, have worked part-time and have been expected to fit this assignment around their regular workloads and commitments. Despite Congressional largesse in the wake of September 11, the total budget for the BPAT has been no more than $1.1m.

To us, the incongruity in these two sets of conflicting facts is glaring and again, with all due respect to the experts on the BPA Team, insulting to the memory of our loved ones.

We believe four things now need to happen.

1. There needs to be an investigation of the BPA. This hearing is a start, but we believe that what is said today and the publication of the BPA Team's report in less than a month will raise more questions. In particular, we would like the Science Committee to question representatives of the American Society of Civil Engineers (ASCE), namely James Rossberg and John Durrant, the Port Authority of New York and New Jersey, namely Frank Lombardi, Joseph Englot and a number of senior legal officers and representatives of the City of New York, in particular, Ken Holden, Commissioner of the Department of Design and Construction.

2. Whatever the conclusions of the BPA and its recommendations for future work there must be a full forensic engineering investigation of the structural and fire-induced failure of the Twin Towers and World Trade Center 7. No aspect of this disaster should be off-limits to what we suggest should be a special Commission of Inquiry. This body should be empowered to call witnesses and experts, and secure whatever documentation, records or plans it requires, by subpoena if necessary. It should have the power to commission research and computer modeling – possibly from the National Institute of Standards and Technology (NIST) and should have an open-ended budget. The inquiry should include the design and construction of the Twin Towers, their maintenance and the evolution of the emergency and firefighting procedures, the 1993 bombing, the lessons learned and applied, an objective assessment of the buildings' condition and state at the time of the attacks, their collapse and as far as possible the failure sequence, and the firefighting, evacuation, search and rescue procedures employed on September 11. Above all, the Commission should take a "lessons learned" or a "what needs to change" approach to its review and analysis of the disaster.

3. As a result of its investigation, the Commission of Inquiry should make firm recommendations for changes that would prevent or significantly reduce the possibility of partial or total collapse and loss of life in a terrorist attack or any other extreme event. The areas covered should be any changes needed in building and fire codes and an assessment of the needs for further fire prediction research and modeling. The Commission should consider in particular whether US building and fire codes now need to provide for acts of terrorism, whether special and separate provision needs to be made for differing heights of high-rise buildings, how fire prevention and defense can be considered as a much more integral part of design, construction and maintenance, whether the exemption of federal buildings from the provisions of local codes is justified, whether fire departments should have the legal authority and resources to enforce the provisions of the fire code, and whether the central core of all high-rise buildings should be cross-braced with steel or even composed primarily of concrete, cement and masonry. In the light of this, the Commission should consider in some detail whether the assumptions on which high-rise fire fighting has been based for nearly thirty years need to be changed.

4. The Commission should draw up a blueprint for a Congressionally mandated, adequately funded, national body to investigate structural failures, whatever their cause. The Commission should consider whether it might be modeled on an existing body with investigative powers, such as the National Transportation Safety Board (NTSB) and should draft the protocols and procedures by which such a body would operate. The Commission should consider the staffing needs and draw up guidelines to ensure it has sufficient independence and autonomy to call upon whatever specialist expertise it may require, particularly if it is to be housed in an existing agency such as NIST or FEMA.

Statement of

International Code Council (ICC)

On

"Learning from 9/11: Understanding the Collapse of the World Trade Center"

Before the

Committee on Science
U.S. House of Representatives
March 6, 2002

Submitted by

Sara C. Yerkes
Government Relations Director
March 12, 2002

The International Code Council (ICC) commends Chairman Boehlert, Ranking Member Hall and Members of the Science Committee for holding the hearing on March 6 on the investigation into the collapse of the World Trade Center Towers.

ICC appreciates the opportunity to submit this written statement addressing the code development process, adoption and enforcement of model building codes in the United States. We respectfully request that this statement be entered as part of the record of the March 6 hearing.

Events of September 11, 2001

The Committee asked the witnesses on March 6 about their role in the investigation of the collapse of the World Trade Center (WTC). Regretfully, ICC was not included as a member of the investigation team to visit the WTC site immediately following the disaster on September 11, 2001. Had ICC been included, we would have brought to the investigation nearly 200 years of experience and expertise on engineering and architectural disciplines, building inspections, building code development and enforcement, and pre-disaster mitigation.

ICC has been actively working in collaboration with other partners. ICC is a signatory on the Partnership Agreement for the Infrastructure Security Partnership (TISP), a dedicated group of public and private organizations who have come together to collaborate on issues related to the security of the nation's built environment. Other TISP members include the American Association of State Highway and Transportation Officials, the US Army Corps of Engineers, Association of State Dam Safety Officials, Veterans Affairs, American Society of Landscape Architects, National Institute of Standards and Technology (NIST), VA Polytech Institute and State University, NASA, National Institute of Building Sciences (NIBS), American Institute of Architects (AIA), Smithsonian, GSA, FEMA, Portland Cement Association and many others. This partnership will work to improve anti-terrorism and asset protection methods and techniques for the built environment; to promote the participation of all interested organizations and to ensure effective communication between all participating entities from the national to the state and local level. And a very important objective for ICC and its membership is to promote the effective and efficient transfer of infrastructure security knowledge from research to codes, standards, public policy and general practice.

ICC has expressed support for NIST's multi-year project approved by the Secretary of Commerce to initiate and conduct independent and comprehensive research on the progressive collapse of WTC. We will work cooperatively with NIST in this investigation. ICC is specifically interested in the study into new technologies or procedures that may reduce the potential risks of such a collapse, and how those procedures may impact building codes.

ICC was also invited by FEMA to join its WTC/Pentagon Recovery Coalition. However, there has been no activity involving ICC on this proposed project.

Construction in the United States

Construction in the United States is a sophisticated process governed by codes and standards that regulate building, plumbing, gas, mechanical, electrical, energy, fire, accessibility and other specialized aspects of construction. The code development process is a dynamic process involving constant interaction between the private and public sectors of the construction industry, Federal, state and local governments, and individuals involved in codes and standards writing and revision representing labor, management, design professionals, building owners, fire officials, and code enforcers.

The code development process in the United States is a private sector activity. ICC is a fully self-supporting nonprofit organization. The revenues used to develop and publish the codes are donated from its member organizations.

Enforcement of Building Codes

The enforcement of building regulations in the U.S. is the role of state and local government. This enforcement authority is derived from the 10th Amendment of the U.S. Constitution which gives states the right to legislate for the protection of the public health, safety and welfare. Most state and local jurisdictions base their regulations on the model codes developed by ICC and its member organizations.

Model Building Code Organizations

Model building codes used throughout the United States since the early 1900s were developed by three model code organizations: the Building Officials and Code Administrators International (BOCA); the International

Conference of Building Officials (ICBO) and the Southern Building Code Congress International (SBCCI). In the 80's and early 90's the professional community associated with the construction industry: architects, engineers, code officials, builders began demanding uniformity in building regulations.

In 1994 the three model code organizations responded by writing their respective codes in a common code format and at the same time founded the ICC. ICC was charged with the mission to develop a comprehensive and compatible regulatory system for the built environment. This was accomplished with the International Codes published in 2000.

The family of International Codes includes building, fuel gas, energy conservation, fire, mechanical, plumbing, property maintenance, private sewage disposal, residential construction, zoning, urban-wildland interface, existing buildings, and a performance code. When a community adopts the International Codes it also benefits from the expertise of hundreds of technical staff, as well as established services that support the codes such as training and certification programs.

ICC Code Development Process

The code development process used by ICC is known as a governmental consensus process. It is an open, inclusive, and balanced consensus process with built-in safeguards to prevent domination by any single interest. The model codes are developed to be accepted into local or state laws. They are developed in the same manner as local governments are required to develop laws. No work is done behind closed doors. There must be a guarantee of fairness in the process, of no conflicts of interest, no vested economic interest in the outcome of the final vote. The code officials represent local government agencies and their interest is the safety and well being of the public. This system of code development has ensured the citizens of the US the highest level of building safety in the world.

The process is detailed and transparent. It incorporates a number of checks and balances to ensure the final documents are of the highest quality.

Participation in the ICC code development process is encouraged and it is open to all groups and individuals. Very briefly explained, the code development process cycle is as follows:

- Code changes are submitted by any interested party
- Code changes are printed and distributed

- An open public hearing is held
- Public hearing results are printed and distributed
- Public comments are sought on public hearing results
- Public comments are printed and distributed
- Final action hearing takes place
- A supplement or new edition of code is published
- And the cycle begins again . . . the code revision cycle is 18 months with new or revised codes being published every three years.

Participants in the process include code officials, other government regulatory agencies, academia, building owners, insurance companies, builders, manufacturers, testing laboratories and others.

The next hearings will be in Pittsburgh from April 8 to April 19, 2002. A notice announcing the April hearings appeared in the Federal Register of February 20, 2002 (67 FR 7671).

97% of Jurisdictions Use International Codes
In a study conducted by the Federal Trade Commission (FTC) in 1988, approximately 97% of cities, counties and states that have adopted and are enforcing building and safety codes are using documents developed by the statutory members of ICC. One of the most recent adoptions happened on the day of the Science Committee hearing when the State of New York celebrated its own historic event by adopting the International Codes effective July 2002. For more information on the International Codes adoptions by local jurisdictions or by state, please visit the ICC website at www.intlcode.org.

Benefits of a Unified System
The International Codes unified system provides substantial benefits to stakeholders who can now work with a consistent set of requirements throughout the United States. A unified system enhances economic development through the utilization of state-of-the-art technology in materials research, design and construction practices. A streamlined building regulatory system through a single family of codes brings consistency and compatibility to multiple layers of requirements existing at all levels of government. One system permits manufacturers to put their efforts into research and development, thus advancing innovation through performance based provisions that require consistent and predictable levels

of building performance and safety. A unified system allows the ICC and industry partners to focus resources on training for the code users and enforcers.

Support of the International Codes

The International Codes have the support and endorsement of government and national organizations such as FEMA, U.S. Department of Housing, American Institute of Architects, American Gas Association, American Planning Association, American Seniors Housing Association, American Institute of Building Design, Building Owners and Managers Association, Insurance Building Code Coalition, National Apartment Association, National Association of Home Builders, National Multi Housing Council and more.

ICC's Professional Support for the International Codes

ICC offers technical, educational and informational products and services through its 360 dedicated and professional staff members at 18 offices throughout the United States.

Conclusion

We concur with Dr. Arden Bement, Director of NIST and reiterate support for his concluding remarks before the Committee on March 6, that the private sector is willing to take whatever corrective actions are necessary to ensure the built environment is safe and strong. We add that the code development process serves the public best as a private sector activity, leaving the enforcement of the building and safety codes under the jurisdiction of state and local governments.

Thank you again for the opportunity to submit this statement. ICC would be pleased to provide additional information or to respond in more detail to any questions from the Committee.

I may be reached at 703-931-4533, ext 12 or by email: yerkes@intlcode.org

The Skyscraper Safety Campaign:
A Project of Parents & Families of
Firefighters and WTC Victims

Sally Regenhard
PO Box 70
Woodlawn Station
Bronx, NY 10470

March 8, 2002

Congressman Sherwood Boehlert
Chairman, Science Committee
House of Representatives
Washington, D.C.

Dear Chairman Boehlert,

On behalf of myself and the Campaign for Skyscraper Safety, we want to profoundly thank you for holding Wednesday's critical hearing on the World Trade Center Disaster. We are extremely grateful for your most evident dedication and hard work, and that you have begun the process of examining several of the issues of concern to us.

We feel that given the many "turf" issues which have arisen and the many unanswered questions that were raised at the hearing, we ask you to consider the request that an Independent Commission be impaneled by President Bush to immediately take charge of the investigation. An Independent Commission would allow for a fresh and comprehensive look at all of the WTC disaster issues. It would also provide the public with a high level of comfort, knowing that the independent nature of a Commission would allow it to focus upon learning the truth and lessons of September 11th.

If such a Commission is possible, we would respectfully request to have some input regarding the direction and composition of such a body. We visualize a broad ranging investigation that might involve members of the academic community, the NTSB and ATF, Fire Service Professionals, Engineers, and Victims' Groups representatives. It is our understanding that President Bush has the authority to appoint such a Commission under the Federal Advisory Committee Act, as amended (5 U.S.C. App 1.) I respectfully request that you convey this desire to President Bush on our behalf.

Thank you again for your wonderful efforts. We appreciate your sincere desire for the lessons of September 11th to be learned for the protection of the American public.

Sincerely,

Sally Regenhard

Sally Regenhard, Chairperson
(718) 671-7328
cell: (518) 287-6203

Federal Emergency Management Agency
Washington, D.C. 20472

March 18, 2002

The Honorable Sherwood Boehlert
Chairman, Committee on Science
U.S. House of Representatives
2246 Rayburn House Office Building
Washington, D.C. 20515-3223

Dear Mr.Chairman:

The hearing on Wednesday, March 6th gave us both much to consider. I wanted to express my appreciation for the way in which you conducted the hearing. You indicated at the end of the hearing that you will call another hearing after the publication of the Building Performance Assessment Team (BPAT) report.

In order to have a productive second hearing, I would like to propose the following course of action, with your concurrence:

1) First, I will begin holding regular press availabilities in order to keep the public informed. The Federal Emergency Management Agency (FEMA) will work with your staff so that they may attend these briefings by phone. Dr. Arden Bement, Director of the National Institute of Standards and Technology (NIST) and The American Society of Civil Engineers (ASCE) have agreed to participate so that we can give the public the most up to date information. Knowing your close ties to the families involved, as we prepare to do these press availability sessions, I would appreciate any insights or suggestions from your staff to include on the agenda, so that we are able to be the most proactive and thorough as possible.
2) Regarding the BPAT report, I have requested that the National Science Foundation (NSF) participate with FEMA, NIST and ASCE to conduct a broad review of the report in order to assure that the findings and recommendations for further study are comprehensive. On this panel, I have asked all of the witnesses from your hearing to participate, including Dr. Astaneh-Asl and Professor Glenn Corbett. Importantly, I have also asked Chief Ed Stinnette, a prominent Fire Chief, to participate in these efforts. This external review process will be completed in a timely enough fashion to hold to the prospective publication date of approximately late April.
3) I have spoken to Director Joe Allbaugh and he is committed to supporting a request for sufficient resources for NIST to continue the study effort this year.
4) Relying on an existing Memorandum of Understanding with the National Institute of Standards and Technology, Dr. Arden Bement and I have established a quick deployment mechanism for NIST to respond to another extreme event, for Presidentially declared disasters. Any deployment will be a joint decision between FEMA and NIST. Within two weeks this protocol will be captured in a revision to our MOU, as a short-term remedy.

I would appreciate the Chairman's concurrence in this course of action, or your guidance on an acceptable approach. Please have a member of your staff contact Vince Fabrizio in our Congressional and Intergovernmental Affairs Office at (202-646-4500) so that we may proceed with your insights.

Please be assured that I share your concern that the Federal government develop a more comprehensive and coordinated process from which to better conduct the necessary research and investigation in the aftermath of tragedy to save lives in the future. I look forward to working with you and your staff in pursuit of this endeavor.

Sincerely

Robert F. Shea, Jr.
Acting Administrator, Federal Insurance
and Mitigation Administration

Cc: The Honorable Ralph M. Hall
Ranking Minority Member
House Science Committee

Committee on Science

SHERWOOD BOEHLERT, CHAIRMAN
Ralph M. Hall, Texas, Ranking Democrat
www.house.gov/science

March 19, 2002
Press Contacts:
Heidi Mohlman Tringe (Heidi.Tringe@mail.house.gov)
Jeff Donald (Jeffrey.Donald@mail.house.gov)
(202) 225-4275

FEMA ANNOUNCES POLICY SHIFTS IN LETTER TO BOEHLERT

Changes To Be Made in Response to 3/6 Hearing on WTC Collapse

WASHINGTON - In response to a March 6th House Science Committee Hearing on the investigation into the collapse of the World Trade Center (WTC), the Federal Emergency Management Agency (FEMA) announced several significant shifts in policy yesterday, in a letter to **Committee Chairman Sherwood Boehlert (R-NY)**. FEMA's proposed changes include:

- frequent press briefings to keep the public and the media up-to-date on the federal investigation;
- a broader scientific review of the pending investigation of the WTC collapse; and
- a new agreement with the National Institute of Standards and Technology (NIST) to enable the agency to respond more quickly and to deploy an official investigation team promptly.

The changes respond to criticisms leveled at the Science Committee hearing. "We need an enhanced disaster investigation protocol in place so that from minute one, someone will assume a recognized leadership role. Someone has to be in charge or no one is, and that is unacceptable," said Chairman Boehlert on March 6th. "Second, NIST needs to move forward with its more extended work on the lessons of the collapse."

Robert F. Shea, Jr., Acting Administrator of the Federal Insurance and Mitigation Administration, testified on behalf of FEMA at the hearing, and sent the letter to Boehlert. "Please be assured that I share your concern that the Federal government develop a more comprehensive and coordinated process from which to better conduct the necessary research and investigation in the aftermath of tragedy to save lives in the future," wrote Shea.

In response to the letter Boehlert stated, "I'm pleased that FEMA is taking the first steps to correct the problems that emerged so graphically at our hearing. There is still more to do, including enabling NIST to conduct a thorough follow-up investigation. We will be having further hearings to ensure that the problems uncovered after this tragedy are corrected in the future."

Federal Emergency Management Agency
Washington, D.C. 20472

DEC 18 2001

Mr. Francis J. Lombardi, P.E.
Chief Engineer
The Port Authority of New York and New Jersey
241 Erie Street
Jersey City, NJ 07310

Dear Mr. Lombardi:

I am requesting your assistance in obtaining copies of plans for World Trade Center (WTC) Towers (Buildings 1 and 2) and WTC Buildings 4, 5, and 6 to support an ongoing engineering study of buildings and infrastructure affected by the collapse of the World Trade Center Towers. Your support will be of considerable public benefit and will be acknowledged in the final report. Let me briefly describe the engineering study.

The Federal Emergency Management Agency (FEMA) is partnering with the American Society of Civil Engineers (ASCE), the State of New York, and the New York City Department of Design and Construction (DDC), and the Structural Engineers Association of New York (SEAoNY) to study the engineering performance of buildings and infrastructure affected by the collapse of the World Trade Center Towers (the WTCT Study). The purpose of the WTCT study is to determine and report on what lessons the engineering profession can learn from the damage that occurred as a result of the terrorist attacks. FEMA, ASCE, DDC and SEAoNY all agree that the requested plans will be used only for purposes of this study. These documents will not be shared with any other parties without your knowledge and written consent.

If you could provide the drawings described below, the engineering team could better understand the building response to the impact and blast of the airplanes and the related debris from the towers and the ensuing fires. All of the team members, including DDC, SEAoNY and all individual participants in the WTCT Study, have signed Confidentiality Agreements with FEMA and ASCE, which include the following restrictions:

> FEMA Building Performance Assessment Team Confidentiality Agreement
>
> Subcontractors and all members of the Building Performance Assessment Team herein called BPAT, agree not to divulge to third parties, or permit access to, information of any nature pertaining to the WTCT Study or to this agreement. Specifically, subcontractors and all other members of the BPAT agree to maintain information developed during BPAT field deployment and report preparation process in the strictest confidence. Upon request by FEMA, all

> such information shall be returned to FEMA or to the party which furnished such information to BPAT. Disclosure of information may only occur: (i) when authorized in writing by the Federal Emergency Management Agency, herein called FEMA; and (ii) in response to a written request for such disclosure which was received by Paul Tertell, Senior Engineer, Federal Emergency Management Agency, Room 410, 500 C St., SW, Washington, DC 20471; and (iii) subject to the terms of this confidentiality agreement.
>
> ASCE Release, Confidentiality and Conflict Disclosure Form
>
> In consideration of being permitted to participate on the American Society of Civil Engineers ("ASCE") Disaster Response Study Team ("Study Team"), I represent and agree as follows:
>
> I agree that all reports, data, work, or other information obtained through my participation with the Study Team shall remain confidential and shall not be disclosed to any third party, except as authorized by ASCE or as otherwise required by law. I agree that all works prepared by me or the Study Team during the course of my work with the Study Team are irrevocably assigned to ASCE, and shall remain the exclusive property of ASCE.

A complete copy of the form of the signed confidentiality agreements is attached to this letter.

Prior to the publication of the report, the Port Authority and Leslie E. Robertson Associates RLLP (LERA) each have the right to review the report of the results of the WTCT Study relating to content derived from BPAT's review of the drawings. FEMA expects to complete a report by March 2002.

To support the study of the WTC buildings, we would like to obtain and review architectural, mechanical and structural drawings for the building. Our only purpose in reviewing the drawings is to obtain information about the building design and/or construction at the time of the September 11 events. We understand that the drawings may not accurately depict all aspects of the as-built conditions as the WTC buildings prior to the attack.

We understand that there are numerous drawings for each building. We would like to have Bill Baker, one of the Team members, or one of his associates at SOM under his direction, contact Bill Faschan at LERA to arrange for selecting drawings:

William Baker
Skidmore, Owings, & Merrill LLP
224 S. Michigan Avenue
Chicago, IL 60604
312-360-4548

Upon completion of the WTCT Study, if requested by the Port Authority, all members of the BPAT shall return all copies of the drawings and plans furnished in response to this request, with the exception of a record set to be maintained by FEMA.

Thank you for your consideration of this request. If you have further questions, I can be contacted at 202-646-3935.

Sincerely,

Paul Tertell

Paul Tertell, P.E.
Program Manager
Building Performance Assessment Team
Federal Emergency Management Agency

cc: Bill Faschan, Partner, Leslie E. Robertson Associates, RLLP
Jim Rossberg, Director, ASCE, Structural Engineering Institute
Bill Baker, Partner, Skidmore, Owings, & Merrill LLP
Therese McAllister, Ph.D., P.E., BPAT Technical Manager, Greenhorne & O'Mara Inc.

THE PORT AUTHORITY OF NY & NJ

FRANCIS J. LOMBARDI
CHIEF ENGINEER
ENGINEERING DEPARTMENT

PORT AUTHORITY TECHNICAL CENTER
241 ERIE STREET, ROOM 230
JERSEY CITY, NJ 07310

(201) 216-2579

December 26, 2001

Mr. Paul Tertell, P.E.
Program Manager
Building Performance Assessment Team
Federal Emergency Management Agency
Washington, D.C. 20472

Re: December 18, 2001 letter from Paul Tertell, requesting plans of designated World Trade Center Buildings for reference in connection with a study of the engineering performance of buildings and infrastructure affected by the collapse of the World Trade Center Towers (the "WTCT Study") being conducted by the Federal Emergency Management Agency (FEMA), together with the American Society of Civil Engineers (ASCE), the State of New York and the New York City Department of Design and Construction (DDC), and the Structural Engineers Association of New York (SEAoNY) (The December 18, 2001 letter is referred to as "the Request".)

Dear Mr.Tertell:

In accordance with the Request, The Port Authority of New York and New Jersey ("Port Authority") will make available to the Building Performance Assessment Team ("BPAT") for use in connection with the WTCT Study, the plans and drawings for Towers 1 and 2 of the WTC and for WTC buildings 4, 5 and 6 (collectively, the "WTC Plans"). Members of the BPAT are members and/or employees of FEMA, ASCE, DDC and/or SEAoNY who are performing work on the WTCT Study.

The WTC Plans are furnished to the BPAT solely for its use in the conduct of the WTCT Study and for no other purpose. All such use is subject to the terms of the Request (a copy of which is annexed hereto)* including, without limitation, its provisions regarding:

1. The written acceptance by all of the participating BPAT members of the provisions in the Request regarding nondisclosure and confidentiality of the WTC Plans.

2. The Port Authority and Leslie E. Robertson Associates review of the report of the WTCT Study prior to its publication relating to content derived from BPAT's review of the WTC Plans.

3. The requested plans will be used only for purposes of the WTCT Study.

*The item is not included in this publication.

You understand that the drawings may not accurately depict all respects of the as-built conditions prior to the attack. Upon completion of the WTCT Study, you shall return all copies of the WTC Plans to the Port Authority with the exception of one record set.

Sincerely,

Francis J. Lombardi, P.E.
Chief Engineer

cc: Bill Faschan, Partner, Leslie E. Robertson Associates, RLLP
Jim Rossberg, Director, ASCE, Structural Engineering Institute
Bill Baker, Partner, Skidmore, Owings, & Merrill LLP
Therese McAllister, Ph.D., P.E., BPAT Technical Manager, Greenhorne & O'Mara Inc.

Atts.

Building Performance Assessment Team
Confidentiality Agreement

Modified 18 December 2001 for World Trade Center Drawings
From The Port Authority of New York and New Jersey

Subcontractors and all members of the Building Performance Assessment Team herein called BPAT, agree not to divulge to third parties, or permit access to, information of any nature pertaining to the World Trade Center Tower Study or to this agreement. Specifically, subcontractors and all other members of the BPAT agree to maintain information developed during BPAT field deployment and report preparation process in the strictest confidence. Upon request by FEMA, all such information shall be returned to FEMA or to the party which furnished such information to BPAT. Disclosure of information may only occur: (i) when authorized in writing by the Federal Emergency Management Agency, herein called FEMA; and (ii) in response to a written request for such disclosure which was received by Paul Tertell, Program Manager, Building Performance Assessment Team, FEMA, 500 C Street SW, Washington, DC, 20472; and (iii) subject to the terms of this confidentiality agreement.

Subcontractors may not assign this Agreement or the process therefrom, nor employ lower-tier subcontractors without the express written permission of Greenhorne & O'Mara, Inc.

Subcontractor agrees to abide by all applicable provisions of the Prime Contract between Greenhorne & O'Mara, Inc., and Owner. Greenhorne & O'Mara, Inc., shall make copies of such Prime Contractor available upon request.

Subcontractor shall be responsible for all damage to life and property due to its activities in connection with the services required under this Agreement and shall indemnify, defend and hold harmless Greenhorne & O'Mara, Inc., and Owner and their officers, employees, and agents against any claims or legal liability arising out of Subcontractor's wrongful act or negligent performance of its services under this Agreement. Subcontractor shall maintain Workman's Compensation, Employer's Liability, and general Liability insurance and will submit to Greenhorne & O'Mara, Inc., insurance certificates indicating coverage in amounts and with carriers satisfactory to Greenhorne & O'Mara, Inc.

Subcontractor shall advise Greenhorne & O'Mara, Inc., of the name of its manager responsible for supervision of the services covered under this Agreement. Subcontractor warrants that it has no conflict of interest and will acquire none.

ABSG CONSULTING INC.
Firm Name
(ABS CONSULTING)

12/18/01
Authorized Signature Date

RONALD O HAMBURGER, SENIOR VICE PRESIDENT
Type/Print Name and Title

Building Performance Assessment Team
Confidentiality Agreement

Modified 18 December 2001 for World Trade Center Drawings From The Port Authority of New York and New Jersey

Subcontractors and all members of the Building Performance Assessment Team herein called BPAT, agree not to divulge to third parties, or permit access to, information of any nature pertaining to the World Trade Center Tower Study or to this agreement. Specifically, subcontractors and all other members of the BPAT agree to maintain information developed during BPAT field deployment and report preparation process in the strictest confidence. Upon request by FEMA, all such information shall be returned to FEMA or to the party which furnished such information to BPAT. Disclosure of information may only occur: (i) when authorized in writing by the Federal Emergency Management Agency, herein called FEMA; and (ii) in response to a written request for such disclosure which was received by Paul Tertell, Program Manager, Building Performance Assessment Team, FEMA, 500 C Street SW, Washington, DC, 20472; and (iii) subject to the terms of this confidentiality agreement.

Subcontractors may not assign this Agreement or the process therefrom, nor employ lower-tier subcontractors without the express written permission of Greenhorne & O'Mara, Inc.

Subcontractor agrees to abide by all applicable provisions of the Prime Contract between Greenhorne & O'Mara, Inc., and Owner. Greenhorne & O'Mara, Inc., shall make copies of such Prime Contractor available upon request.

Subcontractor shall be responsible for all damage to life and property due to its activities in connection with the services required under this Agreement and shall indemnify, defend and hold harmless Greenhorne & O'Mara, Inc., and Owner and their officers, employees, and agents against any claims or legal liability arising out of Subcontractor's wrongful act or negligent performance of its services under this Agreement. Subcontractor shall maintain Workman's Compensation, Employer's Liability, and general Liability Insurance and will submit to Greenhorne & O'Mara, Inc., insurance certificates indicating coverage in amounts and with carriers satisfactory to Greenhorne & O'Mara, Inc.

Subcontractor shall advise Greenhorne & O'Mara, Inc., of the name of its manager responsible for supervision of the services covered under this Agreement. Subcontractor warrants that it has no conflict of interest and will acquire none.

J.R. BARNETT

Firm Name

12/19/01

Authorized Signature Date

J.R. Barnett Sole Proprietor

Type/Print Name and Title

Building Performance Assessment Team
Confidentiality Agreement

Modified 18 December 2001 for World Trade Center Drawings From The Port Authority of New York and New Jersey

Subcontractors and all members of the Building Performance Assessment Team herein called BPAT, agree not to divulge to third parties, or permit access to, information of any nature pertaining to the World Trade Center Tower Study or to this agreement. Specifically, subcontractors and all other members of the BPAT agree to maintain information developed during BPAT field deployment and report preparation process in the strictest confidence. Upon request by FEMA, all such information shall be returned to FEMA or to the party which furnished such information to BPAT. Disclosure of information may only occur: (i) when authorized in writing by the Federal Emergency Management Agency, herein called FEMA; and (ii) in response to a written request for such disclosure which was received by Paul Tertell, Program Manager, Building Performance Assessment Team, FEMA, 500 C Street SW, Washington, DC, 20472; and (iii) subject to the terms of this confidentiality agreement.

Subcontractors may not assign this Agreement or the process therefrom, nor employ lower-tier subcontractors without the express written permission of Greenhorne & O'Mara, Inc.

Subcontractor agrees to abide by all applicable provisions of the Prime Contract between Greenhorne & O'Mara, Inc., and Owner. Greenhorne & O'Mara, Inc., shall make copies of such Prime Contractor available upon request.

Subcontractor shall be responsible for all damage to life and property due to its activities in connection with the services required under this Agreement and shall indemnify, defend and hold harmless Greenhorne & O'Mara, Inc., and Owner and their officers, employees, and agents against any claims or legal liability arising out of Subcontractor's wrongful act or negligent performance of its services under this Agreement. Subcontractor shall maintain Workman's Compensation, Employer's Liability, and general Liability insurance and will submit to Greenhorne & O'Mara, Inc., insurance certificates indicating coverage in amounts and with carriers satisfactory to Greenhorne & O'Mara, Inc.

Subcontractor shall advise Greenhorne & O'Mara, Inc., of the name of its manager responsible for supervision of the services covered under this Agreement. Subcontractor warrants that it has no conflict of interest and will acquire none.

Construction Technology Laboratories, Inc.

Firm Name

Authorized Signature Date

W. Gene Corley, Senior Vice President

Type/Print Name and Title

Building Performance Assessment Team
Confidentiality Agreement

Modified 18 December 2001 for World Trade Center Drawings
From The Port Authority of New York and New Jersey

Subcontractors and all members of the Building Performance Assessment Team herein called BPAT, agree not to divulge to third parties, or permit access to, information of any nature pertaining to the World Trade Center Tower Study or to this agreement. Specifically, subcontractors and all other members of the BPAT agree to maintain information developed during BPAT field deployment and report preparation process in the strictest confidence. Upon request by FEMA, all such information shall be returned to FEMA or to the party which furnished such information to BPAT. Disclosure of information may only occur: (i) when authorized in writing by the Federal Emergency Management Agency, herein called FEMA; and (ii) in response to a written request for such disclosure which was received by Paul Tertell, Program Manager, Building Performance Assessment Team, FEMA, 500 C Street SW, Washington, DC, 20472; and (iii) subject to the terms of this confidentiality agreement.

Subcontractors may not assign this Agreement or the process therefrom, nor employ lower-tier subcontractors without the express written permission of Greenhorne & O'Mara, Inc.

Subcontractor agrees to abide by all applicable provisions of the Prime Contract between Greenhorne & O'Mara, Inc., and Owner. Greenhorne & O'Mara, Inc., shall make copies of such Prime Contractor available upon request.

Subcontractor shall be responsible for all damage to life and property due to its activities in connection with the services required under this Agreement and shall indemnify, defend and hold harmless Greenhorne & O'Mara, Inc., and Owner and their officers, employees, and agents against any claims or legal liability arising out of Subcontractor's wrongful act or negligent performance of its services under this Agreement. Subcontractor shall maintain Workman's Compensation, Employer's Liability, and general Liability insurance and will submit to Greenhorne & O'Mara, Inc., insurance certificates indicating coverage in amounts and with carriers satisfactory to Greenhorne & O'Mara, Inc.

Subcontractor shall advise Greenhorne & O'Mara, Inc., of the name of its manager responsible for supervision of the services covered under this Agreement. Subcontractor warrants that it has no conflict of interest and will acquire none.

SKIDMORE, OWINGS & MERRILL LLP
Firm Name

William F Baker 12/19/01
Authorized Signature Date

WILLIAM F. BAKER PARTNER
Type/Print Name and Title

Building Performance Assessment Team
Confidentiality Agreement

Modified 18 December 2001 for World Trade Center Drawings From The Port Authority of New York and New Jersey

Subcontractors and all members of the Building Performance Assessment Team herein called BPAT, agree not to divulge to third parties, or permit access to, information of any nature pertaining to the World Trade Center Tower Study or to this agreement. Specifically, subcontractors and all other members of the BPAT agree to maintain information developed during BPAT field deployment and report preparation process in the strictest confidence. Upon request by FEMA, all such information shall be returned to FEMA or to the party which furnished such information to BPAT. Disclosure of information may only occur: (i) when authorized in writing by the Federal Emergency Management Agency, herein called FEMA; and (ii) in response to a written request for such disclosure which was received by Paul Tertell, Program Manager, Building Performance Assessment Team, FEMA, 500 C Street SW, Washington, DC, 20472; and (iii) subject to the terms of this confidentiality agreement.

Subcontractors may not assign this Agreement or the process therefrom, nor employ lower-tier subcontractors without the express written permission of Greenhome & O'Mara, Inc.

Subcontractor agrees to abide by all applicable provisions of the Prime Contract between Greenhome & O'Mara, Inc., and Owner. Greenhome & O'Mara, Inc., shall make copies of such Prime Contractor available upon request.

Subcontractor shall be responsible for all damage to life and property due to its activities in connection with the services required under this Agreement and shall indemnify, defend and hold harmless Greenhome & O'Mara, Inc., and Owner and their officers, employees, and agents against any claims or legal liability arising out of Subcontractor's wrongful act or negligent performance of its services under this Agreement. Subcontractor shall maintain Workman's Compensation, Employer's Liability, and general Liability insurance and will submit to Greenhome & O'Mara, Inc., insurance certificates indicating coverage in amounts and with carriers satisfactory to Greenhome & O'Mara, Inc.

Subcontractor shall advise Greenhome & O'Mara, Inc., of the name of its manager responsible for supervision of the services covered under this Agreement. Subcontractor warrants that it has no conflict of interest and will acquire none.

Greenhorne & O'Mara Inc
Firm Name

Therese McAllister 12-19-01
Authorized Signature Date

Therese McAllister, Ph.D, P.E., Senior Structural Engineer
Type/Print Name and Title

Building Performance Assessment Team Confidentiality Agreement

Modified 18 December 2001 for World Trade Center Drawings From The Port Authority of New York and New Jersey

Subcontractors and all members of the Building Performance Assessment Team herein called BPAT, agree not to divulge to third parties, or permit access to, information of any nature pertaining to the World Trade Center Tower Study or to this agreement. Specifically, subcontractors and all other members of the BPAT agree to maintain information developed during BPAT field deployment and report preparation process in the strictest confidence. Upon request by FEMA, all such information shall be returned to FEMA or to the party which furnished such information to BPAT. Disclosure of information may only occur: (i) when authorized in writing by the Federal Emergency Management Agency, herein called FEMA; and (ii) in response to a written request for such disclosure which was received by Paul Tertell, Program Manager, Building Performance Assessment Team, FEMA, 500 C Street SW, Washington, DC, 20472; and (iii) subject to the terms of this confidentiality agreement.

Subcontractors may not assign this Agreement or the process therefrom, nor employ lower-tier subcontractors without the express written permission of Greenhorne & O'Mara, Inc.

Subcontractor agrees to abide by all applicable provisions of the Prime Contract between Greenhorne & O'Mara, Inc., and Owner. Greenhorne & O'Mara, Inc., shall make copies of such Prime Contractor available upon request.

Subcontractor shall be responsible for all damage to life and property due to its activities in connection with the services required under this Agreement and shall indemnify, defend and hold harmless Greenhorne & O'Mara, Inc., and Owner and their officers, employees, and agents against any claims or legal liability arising out of Subcontractor's wrongful act or negligent performance of its services under this Agreement. Subcontractor shall maintain Workman's Compensation, Employer's Liability, and general Liability insurance and will submit to Greenhorne & O'Mara, Inc., insurance certificates indicating coverage in amounts and with carriers satisfactory to Greenhorne & O'Mara, Inc.

Subcontractor shall advise Greenhorne & O'Mara, Inc., of the name of its manager responsible for supervision of the services covered under this Agreement. Subcontractor warrants that it has no conflict of interest and will acquire none.

Firm Name

19 Dec 01

Authorized Signature Date

James A. Milke

Type/Print Name and Title

October 2000

FEDERAL EMERGENCY MANAGEMENT AGENCY
500 C Street, S.W., Room 350
Washington DC 20472

December 20, 2001

Jeanne Zaino
Fox TV

E-mailed to: Jeanne.Zaino@Foxnews.com

Dear Ms. Zaino:

As you may know, the Federal Emergency Management Agency has contracted Greenhorne and O'Mara, Inc., an engineering firm, to study why the WTC buildings collapsed. I have been contracted by Greenhorne & O'Mara, Inc. to assist them in this effort.

We have gone over the Fox coverage of the attack on the World Trade Center from the first breaking news segment until 48 hours after the attack. While we do have copies of what aired on Fox, it has become necessary to request clean copies of some items – the fonts, banners, bugs and scroll cover up some of the vitally important parts of the buildings that are being studied. This video will only be used by the engineers who are studying the affect of this attack on the World Trade Center complex.

We request dubs of the video from the stationary camera which was positioned south of the WTC possibly on Staten Island or New Jersey. This camera provided continuous coverage of the World Trade Centers from the second impact through the collapse. The video aired between the hours of 9:30am – noon on September 11, 2001.

We request that this video be made available as soon as possible as we are trying to have our report completed during the first quarter of 2002.

I would be happy to come to New York and locate the necessary shots with one of your editors or I can go over what is needed by phone. Thanks for your help. You may reach me by phone at 770-267-3231 or 770-235-3221. E-mail is Hutch855@monroeaccess.net.

Regards,

Bettina Hutchings
For: Greenhorne & O'Mara

FEDERAL EMERGENCY MANAGEMENT AGENCY
500 C Street, S.W., Room 350
Washington DC 20472

December 20, 2001

Mr. Keith McAllister
CNN
Atlanta, GA 30303

Faxed: 404-827-

Dear Keith,

As you may know, the Federal Emergency Management Agency has contracted Greenhorne and O'Mara, Inc., an engineering firm, to study why the WTC buildings collapsed. I have been contracted by Greenhorne & O'Mara, Inc. to assist them in this effort.

We have gone over the CNN coverage of the attack on the World Trade Center from the first breaking news segment until 48 hours after the attack. While we do have copies of what aired on CNN, it has become necessary to request clean copies of some items – the fonts, banners, bugs and scroll cover up some of the vitally important parts of the buildings that are being studied.

We request dubs of the video from the handheld camera positioned at ground level very close to the WTC site. This camera view is from the north and recorded events prior to the collapse of the towers. This video aired between 10am and 11am on September 11, 2001.

I would be happy to come to Atlanta and locate the necessary shots with one of your editors or I can go over what is needed by phone. Thanks for your help. You may reach me by phone at 770-267-3231 or 770-235-3221. E-mail is Hutch855@monroeaccess.net.

Regards,

Bettina Hutchings

FEDERAL EMERGENCY MANAGEMENT AGENCY
500 C Street, S.W., Room 350
Washington DC 20472

December 20, 2001

Filipp Nicolosi
ABC News
47 West 66th Street
New York, NY 10023

Faxed to 212-456-4380 (1/14/02)

Dear Mr. Nicolosi,

As you may know, the Federal Emergency Management Agency has contracted Greenhorne and O'Mara, Inc., an engineering firm, to study why the WTC buildings collapsed. I have been contracted by Greenhorne & O'Mara, Inc. to assist them in this effort.

We have gone over the ABC coverage of the attack on the World Trade Center from the first breaking news segment until 48 hours after the attack. While we do have copies of what aired on ABC, it has become necessary to request clean copies of some items – the fonts, banners, bugs and scroll cover up some of the vitally important parts of the buildings that are being studied. This video will only be used by the engineers who are studying the affect of this attack on the World Trade Center complex.

We request a vhs dub of the video shot by a camera positioned on a building in Midtown Manhattan. This camera provided continuous coverage of the World Trade Centers from the second impact through the collapse. The video aired between the hours of 9:45am – noon on September 11, 2001.

We request that this video be made available as soon as possible as we are trying to have our report completed during the first quarter of 2002. We would like

I would be happy to come to New York and locate the necessary shots with one of your editors or I can go over what is needed by phone. Thanks for your help. You may reach me by phone at 770-267-3231 or 770-235-3221. E-mail is Hutch855@monroeaccess.net.

Regards,

Bettina Hutchings
For: Greenhorne & O'Mara

Building Performance Assessment Team
Confidentiality Agreement

Subcontractors and all members of the Building Performance Assessment Team, herein called the BPAT, agree not to divulge to third parties, or permit access to, information of any nature pertaining to the project or to this Agreement. Specifically, subcontractors and all other members of the BPAT agree to maintain information developed during BPAT field deployment and report preparation process in the strictest confidence. Disclosure of information may only occur when authorized in writing by the Federal Emergency Management Agency, herein called the FEMA, or FEMA's Technical Support and Engineering Contractor, herein called the TS/E Contractor.

Subcontractors may not assign this Agreement or the process therefrom, nor employ lower-tier subcontractors without the express written permission of the TS/E Contractor.

Subcontractors agrees to abide by all applicable provisions of he Prime Contract between the TS/E Contractor and Owner. The TS/E Contractor shall make copies of such Prime Contractor available upon request.

Subcontractor shall be responsible for all damage to life and property due to its activities in connection with the services required under this Agreement and shall indemnify, defend and hold harmless the TS/E Contractor and Owner and their officers, employees and agents against any claims or legal liability arising out of Subcontractor's wrongful act or negligent performance of its services under this Agreement. Subcontractor shall maintain Workman's Compensation. Employer's Liability, general Liability insurance and will submit to the TS/E Contractor insurance certificates indicating coverage in amounts and with carriers satisfactory to the TS/E Contractor.

Subcontractors shall advise the TS/E Contractor of the name of its manager responsible for supervision of the services covered under this Agreement. Subcontractors warrant that it has no conflict of interest and will acquire none.

Subcontractors:

CTL
Firm Name

Authorized Signature Date

Type/Print Name and Title

All Other BPAT Members:

7 Oct 01
Signed Date

W Gene Corley
Type/Print Name

March 2000